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TITLE PAGE

An Exploration of an Innovative Approach to Physical Education (Better Movers and Thinkers) on Children's Coordination and Cognition

Mr Andrew Dalziell

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The University of Edinburgh

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DECLARATION PAGE

Declaration

This is to certify that the work contained within has been composed by me and is entirely my own work. Fidelity checks were completed at each stage with both the quantitative and qualitative data gathering and analysis processes throughout this thesis. No part of this thesis has been submitted for any other degree of professional qualification.

Signed:

ABSTRACT

In Scotland, Health and Well-Being (HWB) has become a core area in school curricula following the introduction of Scotland's Curriculum for Excellence in 2004. Physical Education (PE) is one of the subjects within HWB, which places it within a prominent position to positively influence children's decisions to live a healthy and active lifestyle. Scottish Government guidelines indicate that each child aged 3 – 11 years should receive 2 hours of PE each week and children aged 12 – 18 years should receive 2 periods of PE each week. The percentage of schools achieving 2 hours/2 periods each week is encouraging with 99% of primary schools and 93% of secondary schools in 2015. Some head teachers might have had concerns that increasing the time spent in PE would detrimentally affect academic attainment and achievement in other curricula areas such as numeracy and literacy. Evidence does not support these concerns; some studies showed no detrimental effect whilst other studies identified a beneficial effect as a result of increased time spent in PE. However, the understanding of how these positive effects were mediated remains unclear. The literature considers physical activity (PA) as a potential mediator with more recent studies evaluating the impact of physical activity (PA) on academic achievement and attainment.

A clearer understanding about which approaches to PE and PA are most effective in positively influencing children's learning would be of value aligned with the knowledge of student's experiences and perceptions of PE. The aim of this thesis was to evaluate if a novel approach to PE known as 'Better Movers and Thinkers (BMT)' could positively influence children's coordination and cognition and to evaluate student's experiences of this approach. Three studies were planned to explore this aim.

Study one involved a feasibility study being undertaken with students who were in their sixth year of education (n = 46) within two primary schools from one local authority to

evaluate the feasibility of running BMT as an intervention within school. The study involved pre- and post-testing of two quantitative outcome measures; the Movement Assessment Battery for Children – 2nd Edition and the Lucid Assessment for Schools System as well as collecting qualitative data from the students and class teachers using focus groups and semi-structured interviews to obtain an understanding of their experiences following a 16-week intervention phase.

Academic skills were assessed using the Lucid Assessment System for Schools 8 – 11 and physical testing was undertaken using balance and coordination subtests from the Movement Assessment Battery for Children (2nd Edition). Quantitative results revealed significant increased score changes between pre- and post-test conditions in the areas of phonological skills ($p = .042$), segmentation skills ($p = .014$) and working memory ($p = .040$) in favour of the intervention condition. Analysis of qualitative data from a sample of students from the intervention condition ($n = 8$) and their class teacher indicated good acceptability of BMT as an alternative approach to PE. The results and reflections from study one informed the design of study two.

In response to study one, more specific measures of cognition were used as the nature of the academic skills testing was limited in this area. Similarly, the physical testing did not specifically measure coordination and new physical subtests were added to the outcome variable. Further PA habits were included as an additional outcome measure to control for the effects of student activity levels. Finally, the addition of a follow-up testing phase helped to evaluate if changes did occur between pre- and post-testing similar to study one, would these changes be maintained over time.

The aim of study two was to identify what impact BMT had on children's coordination and cognition. The study involved 6 schools from within the same local authority, 3

acting as the control condition schools (C-schools) and 3 as the intervention condition schools (I-Schools). The schools were selected at random by the Quality Improvement Officer (QIO) within the local authority. There were a number of potential schools and the QIO chose schools based on two criteria: their proximity with one another ensuring that catchment areas would be similar in regard to local history, geography and socio-economic variables and schools where it would be feasible to run the research. Once the schools were identified, their names were placed within opaque-sealed envelopes and a person external to the study chose 3 schools and allocated them to the intervention condition leaving the other 3 as the control condition. Students (n = 150) were all in their sixth year of primary education attending mainstream public school. Study two involved four phases; pre-test, a 16-week intervention phase, post-testing, and, 6-month follow-up testing. Physical activity habits were assessed using the 'Physical Activity Habits Questionnaire for Children (PAQ-C),' coordination was assessed using four patterns of locomotion (crawling on the stomach, creeping on hands and knees, marching and skipping) and cognition was assessed using the 'Cognitive Assessment System (CAS).'

Overall findings from study two suggested significant intervention effects in coordination ($p = .001$) and cognition ($p = .001$) with no significant effects for physical activity habits ($p = .200$). Semi-structured focus group interviews were conducted in each of the 6 schools. Grounded theory was used to identify emergent themes and categories to evaluate student perceptions of their PE experiences following completion of the intervention phase. Analysis identified that BMT provided different experiences compared with traditional approaches to PE suggesting that key aspects of BMT should be incorporated into the delivery of PE lessons to build on current good practice. These aspects include the direct focus on developing the children's ability to move and think simultaneously and, directly targeting the development of Executive Function (EF) skills.

The findings from this thesis have implications for Continued Lifelong Professional Learning (CLPL) for primary school teachers and for specialist PE teachers. The findings may also influence course programmes within Initial Teacher Education (ITE) and specialist PE training and for future PE programme design.

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Finally, to the best friend I have ever lost in my life……..this one is for you Dad!

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CHAPTER 1: INTRODUCTION

1.1 Context of the research

The Scottish government introduced a policy recommendation for each student aged 5 – 11 years in primary education to receive two hours of Physical Education (PE) lessons each week, and students aged 12 – 18 years in secondary education to receive two periods of PE each week (Scottish Executive, 2003). Whilst the percentage of schools achieving this target is now high – 99% in primary schools and 93% in secondary schools – the focus has now changed to the quality of experience the students are receiving in PE and the benefits that may be associated with participating in PE and Physical Activity (PA) (Education Scotland, 2015b; Scottish Government, 2015). PA is defined as any movement with the body that results in some level of energy expenditure (Caspersen, C.J., Powell, K.E., & Christenson, G.M., 1985) The quality of PE experience for all students is informed by 'Curriculum for Excellence (CfE),' educational guidelines providing a framework for the delivery of 'Health and wellbeing' which is a key curriculum area within schools and the area that PE is located within mainstream education. For the purposes of this thesis PE refers to instructional lessons within mainstream school in activities, exercises and sports.

Internationally there have been an increasing number of studies evaluating the benefits of participation in PE, PA and sport for children and youth (Ahn, S. & Fedewa, A.L., 2011; Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R., 2009; Bocarro, J.N., Kanters, M.A., Cerin, E. *et al.*, 2012; British Heart Foundation National Centre, 2014; Hansen, L. & Sanders, S., 2010). Sport is referred to in this thesis as an activity involving physical exertion and skill in which an individual or team competes against another. Regular participation in PE, PA and sport has been associated and linked with

improved health and wellbeing with specific reference to cognition, academic achievement, academic attainment and executive function development (Booth, J.N., Tomporowski, P.D., Boyle, J.M. *et al.*, 2013; Coe, D.P., Pivarnik, J.M., Womack, C.J., Reeves, M.J., & Malina, R.M., 2006; Diamond, A. & Lee, K., 2011). Some of the studies have focused on particular populations such as those children with specific learning disabilities or those children who are overweight or obese (Bedell, G., Coster, W., Law, M. *et al.*, 2013; Davis, C.L., Tomporowski, P.D., Boyle, C.A. *et al.*, 2007; Donnelly, J.E., Greene, J.L., Gibson, C.A. *et al.*, 2009; Guiney, H. & Machado, L., 2013). Reviews of these studies have suggested that whilst there are some causal links associated to improved score changes in a variety of attributes (i.e. cognition, health and wellbeing, attainments) following participation in PE, PA and sport, the score changes observed are typically small and the quality of the research is low (Biddle, S.J.H. & Asare, M., 2011; Etnier, J.L., Nowell, P.M., Landers, D.M., & Sibley, B.A., 2006; Haapala, E., 2012). Whilst some studies have focused on cognitive aspects (i.e. memory, executive function, attention and concentration), others have focused on physical activity habits. Few studies have considered the impact that participation in PE, PA and sport has on coordination[1], a key component in being able to effectively participate in PE, PA and sport. There are studies which have investigated quantitative score changes in relation to academic achievement and academic attainment as a result of participating in PE classes and other studies which have investigated student and teacher perceptions and experiences of PE (Dyson, B., 2006; Erickson, F. & Shultz, J., 1992; Gabrus, S.L., 2014; Gray, S., Sproule, J., & Wang, C.K.J., 2008). However, in order to understand the nature of PE lessons in schools and in order to justify claims for the benefits of PE in schools, it is of value to consider both the quantitative and qualitative methodologies together. According to Reid

[1] 'Coordination' refers to the different elements of making body parts work together effectively

(2013), PE is about the development of the whole child and has the ability to impact on four domains; physical, social, emotional and cognitive development (Reid, A., 2013). If we are to solely consider score changes in quantitative data associated with cognitive aspects we omit the opportunity to understand the experiences and perceptions the students have of PE and thus the chance to evaluate if and how PE affects each of the four domains that Reid outlines.

1.2 Purpose and significance of the research

The aim of the research reported in this thesis is to evaluate the impact of a new PE programme called "Better Movers and Thinkers (BMT)" on coordination, cognition and physical activity habits in comparison to current PE provision within Scotland. The research will also evaluate the experiences and perceptions of students who receive BMT as their PE provision. This will provide an opportunity to identify if the students are motivated and engage with BMT allowing the research to identify which aspects of this approach are more effective at encouraging student participation in PE. In gathering both quantitative and qualitative data, it is anticipated that findings may help in providing evidence that can support and inform future policies and practices for PE within schools in Scotland and internationally.

1.3 Summary of individual chapters

Chapter 2 provides a literature review of the range of factors that can impact upon students' engagement, enjoyment and value of PE within the school curriculum. The chapter outlines key aspects of child development and sociological influences that have the potential to enhance students' experiences and perceptions of PE positively whilst

acknowledging the negative influences that these key aspects can have if not addressed and/or considered.

Chapter 3 extends the information from the literature review in chapter 2 focusing specifically on the links between PA and academic achievement and the relationship between cognition and EF skills with PA. Chapter 3 provides a protocol of study one including the study design and methods.

Chapter 4 discusses differences between genders in relation to learning and learning behaviours. A diagrammatic of the BMT learning framework and the BMT process are also provided in this chapter. Chapter 4 provides the results and conclusions from a feasibility study which aimed to identify if BMT could be an alternative approach in the delivery of PE within schools, and to identify the efficacy of its inclusion. The analysis and evaluation of information obtained from this study (study one) helped to inform the design of study two.

Chapter 5 provides further theoretical background and a protocol for study two including design and methods as well as ethical considerations. Chapter 6 is a detailed analysis and discussion of the quantitative results from study two.

Chapter 7 extends on the literature review in Chapter 2 specifically focusing on teacher effectiveness and the nature of PE programmes. The analysis and discussion of the qualitative results from student focus groups are outlined and discussed in this chapter.

Chapter 8 provides an overall discussion of chapters 2 to 7 and culminates with key conclusions, practical recommendations, ideas for future research; an acknowledgement of the strengths and weaknesses of the research within this thesis and finally my own personal learning reflections.

CHAPTER TWO: UNDERSTANDING FACTORS THAT INFLUENCE STUDENT ENGAGEMENT IN PE

2.1 Introduction

There are many factors that impact on student's access to the Physical Education (PE) curriculum within school and in turn impact upon students' participation within PE which may both negatively and positively influences the value that students' place on PE as a core subject within mainstream education (Tannehill, D., MacPhail, A., Walsh, J., & Woods, C., 2015). These factors (for example, student-teacher relationship, physical competency, self-confidence, motivation) have the ability to influence students' enjoyment of PE with implications in the longer-term for their future health behaviours (Janssen, I. & LeBlanc, A.G., 2010; Wright, J., Macdonald, D., & Groom, L., 2003). Similarly, the value that teachers' place on PE is also varied and has been found to be linked to their past experiences of PE, their professional training, as well as their confidence in being able to deliver PE lessons that are of both value and meaning to students (Morgan, P. & Bourke, S., 2008). Parents' may also influence their children's perceptions of PE, again impacting on their child's engagement with PE throughout their school years (Mulvihill, C., Rivers, K., & Aggleton, P., 2000; Na, J., 2015). The purpose of this chapter is to highlight the influence that many factors can have on a students' PE experience including socio-economic status, family, and aspects of motor development whilst outlining the value of physical activity for students' health and wellbeing and educational learning. The chapter then focuses on research which has documented self-determination theory, and the influence of teacher effectiveness, expertise and experience on students' attitudes toward the PE curriculum to provide a context for the current research. Finally, the chapter outlines the development of Better Movers and Thinkers (BMT) as a new approach to the delivery of PE within schools.

The review was carried out using computer searches of ERIC, MEDLINE, Google Scholar, SportDiscuss, PubMed and PsychInfo for relevant articles. Key words included: physical education, physical activity, sport, executive function, cognition, neural development, coordination, child development, education, academic skills, academic attainment, professional development, teaching, learning, self-regulation, social-emotional competence, motivation, and, socio-economic status.

2.2 Socio-Economic Status and Family

Children who come from less stimulating socioeconomic and cultural environments have fewer opportunities to achieve higher levels of development (Grantham-McGregor, S., Cheung, Y.B., Cueto, S. *et al.*, 2007; Marjanovič Umek, L., Kranjc, S., Fekonja, U., & Bajc, K., 2008). Parents and families have an immediate impact on the development of children's physical, social, emotional and cognitive competencies that carries through into many aspects of the child's life from birth (Dwyer, T., Sallis, J.F., Blizzard, L., Lazarus, R., & Dean, K., 2001). The formative first years of a child's life lay the foundations for subsequent development (Smith, P.K., 2011) and children with movement difficulties resulting from lack of opportunities to move are often those who struggle to participate in PE classes when they enter school (Goddard, S., Rowling, M., & Lewis, S., 2004). An association of motor development as well as lower socio-economic status may indeed be a factor contributing to participation in greater levels of physical activity (PA), sport and PE (Green, D., Lingam, R., Mattocks, C. *et al.*, 2011).

Children with movement difficulties are therefore at higher risk of poor health which is often associated with a lack of physical activity and exercise (Haga, M., 2008). An association between children with low levels of PA and poorer cognitive function has been found in a number of recent studies. Findings from one study demonstrated the

importance of early stimulation to cognitive function, indicating that children who had lots of stimulation (for example, opportunities to play and interact with other people and toys) had increased levels of cognition compared to those children who did not have as much stimulation (Trudeau, F. & Shephard, R.J., 2010). Other studies have also shown a positive relationship between socio-economic status and cognitive skills, and in particular executive function skills (EF) (Mezzacappa, E., 2004; Noble, K.G., McCandliss, B.D., & Farah, M.J., 2007). Executive Functioning (EF) is an umbrella term that describes the complex cognitive processes required to perform novel or difficult goal-directed tasks (Diamond, A., Barnett, W.S., Thomas, J., & Munro, S., 2007; Tomporowski, P.D., Davis, C.L., Miller, P.H., & Naglieri, J.A., 2008; Tomporowski, P.D., Lambourne, K., & Okumura, M.S., 2011). Findings from a recent study suggested that early family environments may prove to be especially 'fruitful' contexts for the promotion of EF development. The study identified six ecological risk profiles that best captured the diverse experiences of the families involved. These profiles involved various combinations of family structure (for example, single parent, married/unmarried), income, and psychosocial risks with each having a different impact on EF skills at 36 months of age. The study provides an important understanding about complex relationships that exist between earliest experiences at home and the impact that this can have on the child's future EF development (Rhoades, B.L., Greenberg, M.T., Lanza, S.T., & Blair, C., 2011). Other studies identified that adverse child rearing environments are linked to deficits in EF development amongst children (Beers, S.R. & De Bellis, M.D., 2002; Lewis, E.E., Dozier, M., Ackerman, J., & Sepulveda-Kozakowski, S., 2007). Further research has highlighted the importance of the approach adopted by the parent when raising their child, independent of more general child skills including language and intelligence (Bibok, M., Carpendale, J., & Muller, U., 2009). It would appear that

ecological factors have the potential to play an important role in the development of EF skills in children (Nelson, C.A., Thomas, K.M., & Haan, M., 2006).

It has been identified within the literature that ecological factors impact on cognition, and more specifically on EF development. Research also provides an understanding within the literature that motor and cognitive development are much more intertwined than first realised (Diamond, A., 2000). When considering influences that can impact on students' engagement in PE we therefore need to consider the impact of a child's motor development and thus the interaction between this and EF development.

2.3 Motor Development

In addition to the impact that socio-economic status can have on a child's access to PE, the development of motor competency is also of importance. Children are completely reliant at birth and depend on parents and caregivers for their every need (Smith, P.K., 2011). However from conception through to birth there are a set of survival mechanisms within the motor system that allow the child to cope and assist with being born. These involuntary automatic motor responses are called 'primitive reflexes' that the infant relies on in order to survive in the first few moments of life (Blythe, P. & McGlown, D.J., 1979; Cupute, A.J., Palmer, F.B., Shupiro, B.K. *et al.*, 1984; Eliot, L., 1999; Gallagher, S., 2005; Goddard, S., 2002). Primitive reflexes are automatic responses to certain stimuli which elicit a motoric response that the infant has no conscious control over. They mediate at brain stem level and as a result do not involve higher cognitive functions (Goswami, U., 2008). In essence, babies move without thinking about the why, how or when of movement. During the first year of life, and if the baby is provided with a suitably stimulating environment that encourages lots of movement opportunities (for example, time spent lying in prone on the floor), these primitive reflexes become inhibited,

modified, or are transformed into a more mature form (Blythe, P. & McGlown, D.J., 1979). This allows the baby to gain more control of themselves and in doing so, provide them with the opportunity to choose why, how and when to move (Goddard, S.*, et al.*, 2004). This is an example of the motor system linking directly to cognition, and advances in neuroscience research has demonstrated that motor and cognitive development are interrelated (Diamond, A., 2000). Motor competency is then dependent upon the opportunities a child has to be physically active and to exercise and move in a wide variety of ways in order to improve and refine their physical skills and thus develop good motor coordination (Schmidt, R.A. & Lee, T., 1988). It has been known for many years that the greater repertoire of movements that a child has, the more developed and advanced their motor skills then become (Ayres, A.J., 1972). It could be suggested that children with a limited repertoire of movement skills are therefore not able to fully engage and therefore benefit from PE in the same way as others, who may be described as being more physically literate (Whitehead, M., 2010).

It is known that children with movement difficulties are at increased risk of health related issues that are often associated with low levels of physical activity (Ekelund, U., Jian'an, L., Sherar, L.B. *et al.*, 2012). In a study from Bouffard *et al.,* (1996) children with movement difficulties were noted to be less active during school breaks (for example, morning break and lunchtime) compared to peers who did not present with motor difficulties (Bouffard, M., Watkinson, E.J., Thompson, L.P., Causgrove Dunn, J., & Romanow, S.K., 1996). Similarly, children who present with motor planning limitations and associated difficulties with coordination and balance control are identified as having a clinical diagnosis of 'Developmental Coordination Disorder (DCD).' Children diagnosed with 'DCD' do not reach the same levels of 'moderate-to-vigorous physical activity (MVPA)' throughout the day when compared to their peers who do not present

with ‘DCD’ (Green, D*., et al.*, 2011). ‘MVPA’ is defined as any activity with an energy expenditure above 3 metabolic equivalent units (METs); 1 MET being energy requirement of resting, with an oxygen uptake of 3.5ml/kg (The Department of Health, 2011). Some of the cited benefits of ‘MVPA’ include psychosocial aspects (Hills, A.P., Mokhtar, N., & Byrne, N.M., 2014). Disparities in motor development therefore have far reaching consequences for the health and wellbeing of children and young people (Kohl, r.H.W., Craig, C.L., Lambert, E.V. *et al.*, 2012).

Recent research has reignited interest into the effects that physical activity has on cognition and academic attainment (Biddle, S.J.H. & Asare, M., 2011; Booth, J.N., Leary, S.D., Joinson, C. *et al.*, 2014; Trudeau, F. & Shephard, R.J., 2010). However, there are studies which make the assumption that children have good motor development and do not differentiate between children with movement difficulties and those without movement difficulties (Aktop, A., 2010; Budde, H., Voelcker-Rehage, C., Pietraßyk-Kendziorra, S., Ribeiro, P., & Tidow, G., 2008). Not all children enter their school years with good motor coordination and this can impact on their ability to reach certain levels of MVPA during their school-day and within PE lessons. These are often the children who are identified at higher-risk of learning difficulties (Brown, J.K., & Minns, R.A., 1999). Research indicates that physical exercise fosters the emergence of children’s mental functions, and in particular EF skills (Tomporowski, P.D*., et al.*, 2011). The results from several correlational studies suggest moderate to strong positive associations between the amount of physical activity and academic achievement (Roberts, C.K., Freed, B., & McCarthy, W.J., 2010). Donnelly and Lambourne (2011), for example, found an association between fitness and fatness with cognitive functioning and academic achievement in children (Donnelly, J.E. & Lambourne, K., 2011). However, there is the assumption in these studies that all forms of physical activity provide the same impact

and stimulus to the process of learning but this does not seem likely. Although studies have identified the health risks associated with low levels of physical activity, there are educational issues in relation to low levels of physical activity that are of equal concern but the nature of such impact changes depending on the type of activity being performed (Pesce, C., Crova, C., Marchetti, R. *et al.*, 2013).

Studies have introduced PE intervention programmes to help and support children who are at higher risk of health and learning difficulties associated with poor motor development (Diamond, A.*, et al.*, 2007; Donnelly, J.E.*, et al.*, 2009; Fisher, A., Boyle, J.M.E., Paton, J.Y. *et al.*, 2011). However, the reviews of prospective studies is mixed (Biddle, S.J.H. & Asare, M., 2011; Etnier, J.L.*, et al.*, 2006; Haapala, E., 2012). Where some studies have identified positive benefits through the introduction of an intervention (Dalziell, A.G., Boyle, J., & , & Mutrie, N., 2015b; Donnelly, J.E. & Lambourne, K., 2011; Fisher, A.*, et al.*, 2011) other studies have not been as convincing (Ahamed, Y., Macdonald, H., Reed, K., Naylor, P. J., Liu-Ambrose, T. & McKay, H., 2007; Carlson, S.A., Fulton, J.E., Lee, S.M. *et al.*, 2008). These disparities may be attributed to the use of different outcome measures, population cohorts and different forms of physical activity and different dose response (for example, intensity, duration and frequency of physical activity). Despite such disparities within the literature, there is the common finding that increasing time spent in PE within school – and therefore curtailing the time spent learning academic subjects (for example, literacy and numeracy) – does not result in a decline in academic performance despite concerns from some educationalists (Biddle, S.J.H. & Asare, M., 2011; Etnier, J.L.*, et al.*, 2006).

What is perhaps more concerning is the limited interest in the developmental differences in motor coordination in children given the close interrelation existing between motor and cognitive development and similarly between the development of EF and motor

behaviour (Pennequin, V., Sorel, O., & Fontaine, R., 2010). As a result of the unbalanced attention focused on developmental trends in children's fitness and coordination, PA guidelines for young people rarely consider aspects other than intensity, frequency and duration of activity (Dwyer, G.M., Baur, L.A., & Hardy, L.L., 2009). There is a paucity of research examining the cognitive or social interaction demands of PA as well as its motor coordination demands (Best, J.R., 2012; Budde, H.*, et al.*, 2008; Pesce, C., Crova, C., Cereatti, L., Casella, R., & Bellucci, M., 2009). Cognitive benefits depend, in part, on individual differences in motor development and the level of cognitive challenge (Pesce, C.*, et al.*, 2013). Therefore the way in which PA mediates improvements in cognitive functions, and in particular EF, is likely to be affected by task variables such as the intensity, duration and complexity and certain individual characteristics such as psychosocial factors, current fitness levels, physical competency, self-motivation and self- esteem (Diamond, A., 2013; Pesce, C.*, et al.*, 2009; Tomporowski, P.D.*, et al.*, 2011).

2.4 Self-Determination Theory

There has been a great deal written in the literature about the value that PA can have on both physical and mental health and wellbeing of children and young people (Aktop, A., 2010; Azzarito, L. & Ennis, C.D., 2003; Cavill, N., Biddle, S., & Sallis, J.F., 2001). One of the most important indicators of psychological wellbeing is considered to be that of self-esteem (Biddle, S.J. & Mutrie, N., 2007). Self-esteem refers to the value and worth that we hold of ourselves and the perception we think others have of us. Self-esteem has been identified as an important element in the onset of childhood mental disorders making it essential to consider self-esteem in relation to PE interventions and children's mental health (Ekeland, E., Heian, F., Hagen, K., & Coren, E., 2005). Higher intensity exercise

has been associated with neurological, physiological and cognitive factors that mediate the relationship between PA and mood (Ahn, S. & Fedewa, A.L., 2011).

However, for students' to gain such benefits they have to have a willingness and the ability to participate in PA and PE lessons. Students' willingness and ability are conditioned upon their levels of motivation and within the literature there are a variety of theories that promote motivation (Ames, C., 1992; Dweck, C.S. & Leggett, E.L., 1988; Hagger, M.S. & Chatzisarantis, N.L., 2014; Nicholls, J.G., 1984; Ryan, R.M. & Deci, E.L., 2000). Most of these theories share the common understanding that motivation is influenced through intrinsic factors, such as the desire to participate in PE and extrinsic factors, such as the relationship between the student and the teacher (Hagger, M.S. & Chatzisarantis, N.L., 2007). For the purposes of this thesis, 'Self Determination Theory (SDT)' has been selected on the basis that it facilitates intrinsic and extrinsic motivation (Ryan, R.M. & Deci, E.L., 2000). For example, Ryan & Deci (2000) postulate that there are three psychological needs which when satisfied result in enhanced self-motivation and self-esteem; competence, autonomy, and relatedness (Ryan, R.M. & Deci, E.L., 2000). These three psychological needs provide the framework upon which self-determination theory (SDT) exists and have informed the philosophy of BMT, which focuses on the development of; physical literacy, thinking skills, and personal qualities to enhance performance (Education Scotland, 2015a).

However, if PE programmes are to be successful in engaging students' in PE and PA, then they need to consider such models of behaviour change within their design. The design of BMT has considered and been influenced by 'SDT' but student engagement with BMT will also be influenced in how the programme is delivered by teachers.

Motivation is typically enhanced in those students whose motivation is 'authentic' (self-initiated) when compared to those students whose motivation is driven externally (Sheldon, K.M., Ryan, R.M., Rawsthorne, L.J., & Ilardi, B., 1997). This 'authentic' motivation is encouraged more effectively in schools where teachers create an 'autonomy supportive environment' (Ryan, R.M. & Deci, E.L., 2000). Such environments allow students to have more of an interest in the activities, greater excitement, and better confidence which enhance performance, persistence and creativity (Ryan, R.M., 1991; Sheldon, K.M*., et al.*, 1997). This leads to heightened vitality, self-esteem and thus general wellbeing (Nix, G.A., Ryan, R.M., Manly, J.B., & Deci, E.L., 1999; Ryan, R.M. & Deci, E.L., 2006; Ryan, R.M., Deci, E.L., & Grolnick, W.S., 1995). If circumstances then permit, intrinsic motivation and thus a willingness to participate in PE will 'flourish' (Ryan, R.M. & Deci, E.L., 2000).

Teachers who are less controlling and authoritative encourage greater levels of intrinsic motivation within their students because in doing so they allow a greater feeling of autonomy which enhances curiosity and a desire for challenge in their students (Flink, C., Boggiano, A.K., & Barrett, M., 1990; Ryan, R.M. & Grolnick, W.S., 1986). In contrast, students who are taught in a more controlling approach tend to learn less effectively as they lose initiative (Utman, C.H., 1997).

However, although teachers' set-up an autonomy supportive environment, this does not therefore automatically result in engaged and motivated students. The ability to respond favourably to such learning environments is contingent upon the development of good EF skills (Tomporowski, P.D*., et al.*, 2011). EF skills allow students to develop such capacities as delayed gratification, inhibit impulsive responses and to plan and prioritise processes that effectively and consistently lead to targeted outcomes being realised (Education Scotland, 2015a). Enhanced EF is associated with improved self-regulation

giving students the ability in school to analyse their environment and decide the appropriate plan of action (Hofmann, W., Schmeichel, B.J., & Baddeley, A.D., 2012). Self-regulatory behaviours predict social skills, relationships with teachers and peers, school engagement and health and wellbeing (Eisenberg, N., Valiente, C., & Eggum, N.D., 2010).

Despite the evidence and knowledge in support of SDT and EF skills there are many children who opt out of PE lessons due to low self-esteem that is often associated with low levels of perceived physical and social competence (Garrett, R., 2004). According to Ahn & Fedewa (2011) one subset of the student population that is at a particularly higher risk of mental health disorders are those students classified as overweight or obese (Ahn, S. & Fedewa, A.L., 2011). Other studies identify adolescent girls at greater risk (Cury, F., Biddle, S., Famose, J.P. *et al.*, 1996). Similarly, the relationship between socioeconomic status and EF skills also suggests that students from less affluent backgrounds are also at an increased risk of mental health disorders (Hook, C.J., Lawson, G.M., & Farah, M.J., 2013). It is imperative therefore that the design of PE programmes and PA interventions acknowledge and address the impact that many factors surrounding SDT can have on students' access to participation.

2.5 Teacher Effectiveness, Expertise and Experience

McKenzie and Lounsbery (2014) indicated that in order for PE to sustain its place as an integral part of the school curriculum, it must deliver 'clear' and 'meaningful' outcomes (McKenzie, T.L. & Lounsbery, M.A.F., 2014). Teacher effectiveness is closely related to students' perceptions of their PE curriculum and are effective in achieving outcomes that are perceived as worthwhile and valuable to students (McKenzie, T.L. & Lounsbery, M.A.F., 2014). Some of these outcomes lie within the public health domain and

McKenzie and Lounsbery (2014) believe that PE has an important role to play within the promotion of public health. However, not all PE professionals envisage public health as the primary purpose of PE (Tinning, R., 2010). For example, Dyson (2014) is fairly adamant that PE is not about advocating some 'mindless physical activity' and is indeed about a much bigger purpose (Dyson, B., 2014). This bigger purpose is in relation to the development of the whole student where PE can embrace aspects relating to the physical, social, emotional and cognitive development of students within its curriculum (Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R. *et al.*, 2009; Reid, A., 2013). Yet, despite such claims as to the value and benefit of PE, in some countries PE continues to have a diminishing role within mainstream school curriculum. This in turn impacts on the quantity and quality of PE and therefore on how effective teachers' can be in delivering PE curriculum (McKenzie, T.L. & Lounsbery, M.A.F., 2014). In considering such factors, it is reasonable to suggest that questions about teacher effectiveness cannot be answered fully without contextualising the status that PE has within school curriculum.

Within the Scottish context PE has received positive support from the government with the introduction of a policy recommendation that PE is to be provided for two hours each week for students aged 5 – 11 years who are in primary education and two periods each week for all students aged 11 – 18 years who are in secondary education (Scottish Executive, 2003). Latest figures from the Scottish Government have shown that 99% of primary schools and 93% of secondary schools are achieving the targets set out in the policy legislation, an increase from under 10% of schools in 2005 (Scottish Government, 2015). Whilst this a reassuring acknowledgement that the majority of students within Scottish schools are receiving regular PE, there are concerns over the quality of experience that students receive as part of their PE curriculum (Education Scotland, 2015c).

The effectiveness of PE curriculum is clearly contingent upon the experience and expertise of teachers in being able to deliver high quality lessons within PE. McKenzie and Lounsbery (2014) state that the evidence is clear that the PE teacher is a major influence in the delivery of quality PE experiences for all students (McKenzie, T.L. & Lounsbery, M.A.F., 2014). Despite such evidence, PE specialists are not a stable feature within primary education in Scotland and the PE curriculum is often being delivered by classroom teachers. Time allocated to PE within initial teacher training courses ranges from 31 to 53 hours throughout their degree courses (Carney, C. & Guthrie, J., 1998). Bailey *et al.* (2009) state that the educational benefits that PE lays claim to in relation to the development of the whole student are highly dependent on contextual and pedagogic values (Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R.*, et al.*, 2009). If pedagogic values influence the benefits of participating in PE, then the expertise, knowledge and experience of teachers, both in primary and secondary education, has considerable bearing on the quality of PE experience students receive. The amount and nature of training that teachers receive initially and as part of their 'Continued Lifelong Professional Learning (CLPL)' will greatly influence their ability to deliver an effective PE curriculum. This in turn will undoubtedly impact upon students' experiences of PE.

The quality of student PE experience will influence student attitudes towards PE and furthermore lifelong PA habits. Evidence indicates that if teachers help to promote positive attitudes toward PE, that students will enjoy PA more and hopefully continue to enjoy PA over a lifetime (Silverman, S., 2005). Furthermore, research into how to create positive changes to student attitude, leading to positive changes in student outcomes, has identified the importance of student perceptions of the teacher and of the PE curriculum (Prusak, K.A., Davis, T., Pennington, T.R., & Wilkinson, C., 2014). Prusak *et al.* (2014) suggest that a better understanding of students' attitudes and beliefs about PE could

greatly influence teacher effectiveness. Studies have found that students often perceive barriers to participation in PE such as a lack of meaning and variety, limited PE opportunities during school hours and limited choices during PE classes (Gibbons, S.L. & Humbert, L., 2008; Hohepa, M., Schofield, G., & Kolt, G.S., 2006). It would appear as though there are many variables that impact on students' attitudes and perceptions of PE. This is not unique to students with studies having identified that some classroom teachers view PE as a 'break for kids' whilst others view PE classes as a time for learning (Graham, G., 2008). It is essential that teachers value PE and make PE enjoyable, helping students to find personal meanings in the activities that inform the PE curriculum (Graham, G., 1995; Hagger, M.S., Chatzisarantis, N.L., & Biddle, S.J., 2002).

Student motivation for PE is determined by many things including the environment and learning contexts that the teacher creates (Ryan, R.M. & Deci, E.L., 2000). How the learning context is established is an important influence on children's internalisation of personal goal orientations (Carr, S. & Weigand, D.A., 2001). Students' motivation is determined by their own personal goals which are emphasised through self-evaluation and reward processes as well as task, authority, competency and grouping structures of the environment (Carr, S. & Weigand, D.A., 2001). Studies have identified that when a teacher focuses on self-improvement and task mastery and then reward effort and personal progression then a 'mastery-oriented' learning environment is created (Roberts, G.C., 1992). Carr & Weigand (2001) suggested that when a class is predominantly 'mastery-oriented' students typically have a higher-task orientation culminating in positive attitudes towards PE (Carr, S. & Weigand, D.A., 2001). Treasure (1993) concluded that teachers are able to create specific motivational climates that will have implications for the development of student motivation by manipulating the structural features of PE lessons (Treasure, D.C., 1993). However, there is a growing concern that

the content knowledge of teachers is limited in PE (Ward, P., 2013). This lack of knowledge has resulted in the continuation of a multi-activity approach to PE as many teachers feel they do not have enough specialised knowledge in particular sports and activities (Kirk, D., 2009; Metzler, M.W., 2005). Whilst some researchers and educationalists support a multi-activity approach, others are hesitant as to the effectiveness of such approaches in PE with concerns that the evaluation of their usefulness focuses more on the fidelity of the curriculum rather than student learning outcomes (Casey, A., 2014; Dyson, B., 2014). Dyson (2014) claims that the PE curriculum should be based on 'pedagogical content knowledge (PCK)' inferring that the art and science of teaching is at the heart of effective teaching of PE. Furthermore, PCK has the potential to create positive learning environments and relationships for the student to connect and relate to the learning (Dyson, B., 2014). These views are supported through other studies that place a significant value on the importance of students' abilities to relate to teachers and learning (Cornelius-White, J., 2007; Roorda, D.L., Koomen, H.M., Spilt, J.L., & Oort, F.J., 2011; Ryan, R.M. & Deci, E.L., 2000). Teacher effectiveness in delivering quality student experiences in PE has to reflect on key aspects of social and emotional development if a relationship between students and the PE curriculum they participate in is to be established. The meaning and value of PE for students should be a key objective of teachers when delivering a PE curriculum, and recent research has shown that teachers can build social and emotional skills in PE (Dyson, B. & Casey, A., 2012).

Teacher effectiveness is contingent upon the position and value that PE has within the school curriculum. The many claims and benefits associated with participating in PE are based upon the quality of experience students' perceive in lessons, the value and meaning they attach to the content within lessons, the motivation they have towards learning in PE

and the relationships they develop with teachers and the PE curriculum. Teachers are in a primary place to positively influence each of these aspects and their effectiveness is influenced through their training, confidence and experience of delivering a PE curriculum. Designing a PE curriculum that can encourage all of these factors to come together in some harmonious way is significantly problematic (Prusak, K.A.*, et al.*, 2014). Nevertheless, in Scotland with a policy recommendation indicating the right of each child to receive regular PE in school, programme designs need to cement PE's place within school curriculum by showing a positive impact in the development of the whole student affecting physical, social, emotional and cognitive domains. One such recent programme is 'Better Movers and Thinkers (BMT).'

2.6 Better Movers and Thinkers

Three key threads from recent research highlights the importance of moderate to vigorous physical activity (MVPA) (Hillman, C.H., Erickson, K.I., & Kramer, A.F., 2008), the role of EF skills (Diamond, A. & Lee, K., 2011), and the need for movement tasks to be complex (Pesce, C*., et al.*, 2013) in enhancing student's learning. Evidence from the research provides a rationale for BMT as an approach to delivering quality PE experiences for students as the BMT approach specifically targets these 3 key threads within each lesson.

BMT is a new and innovative approach when delivering PE within schools. BMT has been constructed through a collaboration of research, information and resources from the fields of cognitive neuro-science, child development, sports performance and developmental psychology. BMT is an approach to learning and teaching in PE designed to develop the ability of students to move and think in a more cohesive and integrated way. Compared to current PE provision, BMT focuses specifically on the development

and enhancement of EF skills. EF skills are considered to be the essential higher-order cortical processes that provide more efficient and effective access to learning throughout school and with lifestyle choices (Diamond, A., 2013). BMT represents an evolution in PE and incorporates pedagogical development and innovative content with current good practice (Education Scotland, 2015a).

One of the clear intentions of PE is to motivate learners to engage purposefully in practical activity and BMT achieves this uniquely by assisting in the acquisition and establishment of key EF skills. BMT is designed to achieve these goals through supporting students to engage with the learning process because movement is exciting, thinking is interesting and participating is enjoyable. BMT enables learners to make stronger connections across the wider school curriculum and as such aims to foster positive student attitudes to PE, PA and sport.

BMT differs from current PE provision in Scotland as it does not prioritise the teaching of a wide range of activities and sports. BMT prioritises and focuses on the development of the 'Significant Aspects of Learning (SAoL)' and uses activities and sports as the learning contexts upon which the SAoLs can be taught (Education Scotland, 2015b). Therefore, in contrast to current PE provision, BMT does not focus on the teaching of specific technical or skill-based models of a sporting or activity performance (for example, the overhead clear in badminton). BMT focuses instead on the key components of physical competency, physical fitness, cognitive skills and personal qualities of the student that allow them to become more successful in a range of activities and sports within their PE curriculum. In essence, BMT provides students with the physical and cognitive tools that are required in order to purposefully participate in PE, PA and sport. The overview of BMT is based on three main elements; moving and thinking, scaffolding practices (coordinated movement suggestions) that help to develop the SAoLs and the

development of EF skills (Education Scotland, 2015a). The integration of these main elements makes BMT different in comparison to current approaches in the delivery of PE curriculum, particularly the specific development of EF skills.

The delivery of BMT involves the student engaging with a physically complex task (for example, a 4 step arm fold sequence). As the student begins to succeed with this physical task, a cognitive task is added (i.e. recite the 3 times table). When the student achieves some success with the physical and cognitive task, the addition of an EF skill is added (i.e. inhibition control where a misdirected cue is provided by the teacher and the student is not to respond to it, for example, shouting 'change' instead of clapping hands to have the student reverse the arm fold sequence). The teacher then evaluates that the student is still engaged with the process of learning before repeating this process by increasing the level of complexity of the physical and cognitive tasks along with the addition of another EF skill or increasing the demand of the current EF skill that has been targeted for development. The pedagogical approach is for the teacher to deliver this information only once and to not repeat instructions encouraging the student to actively listen, actively watch and thus take independent responsibility for their own learning.

In contrast standard PE delivery is designed around the concept of a warm-up, some skill-based drills which culminate in a game or performance and then a cool down. The focus of standard PE is more on the technique development of the skill and the transfer of this into a sporting or activity performance. The pedagogical approach focuses on the child's development but typically has instructions being repeated and the organisation and management of learning being controlled (in part) by the teacher.

2.7 Conclusion

The literature identifies factors which can positively and negatively influence students' engagement in PE. Studies have identified the impact of family structures, income and psychosocial risks on the child's early years and experiences impacting upon children's future physical, social, emotional and cognitive development. Evidence from the literature acknowledges that motor and cognitive development are interrelated and recent research has focused on the relationship between physical and cognitive development with particular reference to EF development. Whilst some studies have found moderate to strong associations between increasing levels of PA and gains in aspects of cognition and academic attainment, some studies have found no associations. This is often dependent on the design and methodology used within studies with many assuming that all kinds of PA will have the same impact, something the literature regards as highly unlikely.

The nature of PE involves movement and physical activity yet for many children they are unable to purposefully engage in PE due to motor difficulties. Students with motor difficulties are less likely to achieve appropriate levels of MVPA and are not able to enjoy the associated benefits of being physically active. This can impact on the students' willingness and ability to participate in PE influencing their motivations for choosing to participate or opt out of PE and PA. If PE programmes are to be effective, then careful consideration of behaviour change theories need to be applied as part of the design of such programmes in the hope of encouraging students to become more physically active and to sustain a healthy lifestyle throughout and beyond their school years. The success of PE programmes has to consider how these factors can be influenced as well as take into consideration the effectiveness of the teacher when delivering lessons in PE.

BMT has been influenced by these factors and through aligning itself with SDT attempts to resolve some of the limitations that the literature outlines. Study one is designed to evaluate the efficacy and feasibility of delivering BMT within school gaining an insight into the potential influence this approach has on students' learning and how students and teachers perceive BMT. Findings from study one have informed the design and methodologies in study two and has provided a more robust evaluation of the impact that BMT has on students' coordination, physical activity habits and cognition as well as the experiences and perceptions of students of BMT.

CHAPTER 3: BETTER MOVERS AND THINKERS (BMT): AN INNOVATIVE APPROACH TO TEACHING PRIMARY SCHOOL PHYSICAL EDUCATION – PROTOCOL FOR A PILOT STUDY

3.1 Introduction

Physical education (PE) has long been considered a valuable subject in schools for both physical and cognitive benefits (Trudeau, F. & Shephard, R.J., 2010). Studies have been conducted to test the potentially beneficial effects of physical activity (PA) on academic achievement, cognition and executive function (Booth, J.N.*, et al.*, 2014; Coe, D.P.*, et al.*, 2006; Etnier, J.L.*, et al.*, 2006). Some studies found no significant change in a memory-search performance task over time as a function of exercise training (Blumenthal, J.A., & Madden, D. J., 1988). A further study found no improvement in performance tests as a function of aerobic exercise training and suggested that the exercise-related improvements in cognitive functioning that have been obtained in past studies are dependent on some aspect of either the exercise protocol or the cognitive performance measures (Madden, D.J., Blumenthal, J. A., Allen, P. A., & Emery, C. F., 1989). A similar study identified no significant differences between groups on all dependent measures when testing for the relationship between physical exertion and mental performance following a PA training period (Zervas, Y., Danis, A., & Klissouras, V, 1991). In 2006, using meta-regression techniques to statistically test the relationship between aerobic fitness and cognitive performance the authors indicated that there was no significant relationship between fitness effect sizes and cognitive effect sizes for studies that used a cross-sectional design or post-test comparisons (Etnier, J.L.*, et al.*, 2006). However, studies before the year 2000 commonly shared the opinion that there may be other physiological and/or psychological variables that may serve to mediate the

relationship between PA and cognitive performance and as such many of the studies recommended that this specific area be further investigated.

More recent research has reignited interest into the effects of PA on academic achievement with some studies specifically highlighting aspects of Executive Functioning for beneficial effects (Best, J.R., Miller, P.H., & Naglieri, J.A., 2011; Diamond, A. & Lee, K., 2011; Trudeau, F. & Shephard, R.J., 2010). Executive Functioning (EF) is an umbrella term that describes the complex cognitive processes required to perform novel or difficult goal-directed tasks (Hughes, C. & Graham, A., 2002), including the ability to delay or inhibit responses, develop a plan of action sequences, and working memory (Welsh, M.C. & Pennington, B.F., 1988). Recent research has highlighted physiological influences such as greater cerebral blood flow and increased secretion of neurotrophins as a result of increasing levels of PA as well as psychological influences such as an increase in self-esteem and a desire to learn and be part of the school (Trudeau, F. & Shephard, R.J., 2010). Other experimental studies have identified that no decrease in academic performance has been observed despite a curtailing of time spent teaching academic subjects in favour for more PA (Ahamed, Y., Macdonald, H., Reed, K., Naylor, P. J., Liu-Ambrose, T. & McKay, H., 2007; Donnelly, J.E.*, et al.*, 2009).

Teachers are faced with an increasing number of demands for curricular time and as such concerns have been raised about increasing the time allocated to PE. Yet, findings from studies in the early 2000's suggested that regular PA had a positive impact on learning and memory at all ages, and furthermore, that early stimulation of brain structures is important to cognitive function in later life (Goswami, U., 2008; Hughes, C. & Graham, A., 2002; Trudeau, F. & Shephard, R.J., 2010). It is suggested that early stimulation increases the reserves of brain function, through increasing the number of neurons and

the extent of their interconnections. There is growing evidence that PA can make a positive contribution to this increase (Biddle, S.J.H. & Asare, M., 2011; Trudeau, F. & Shephard, R.J., 2010). However, recent research has made the assumption that all forms of PA will provide similar stimulation to the learning process; yet, this seems unlikely to be the case. Studies have been conducted to measure the impact of gentle, vigorous and chronic bouts of exercise on academic performance (Coe, D.P*., et al.*, 2006; Davis, C.L. & Cooper, S., 2011; Trudeau, F. & Shephard, R.J., 2010). The findings have suggested that whilst forms of exercise result in benefits to academic performance and EF, these effects are not the same. For example, there is evidence to suggest that relaxing forms of PA may be beneficial at counteracting stress levels for university students nearing final examinations with no similar research being conducted on school-aged children (Giacobbi, P.R., Tuccitto, D. E. & Frye, N., 2007). In contrast, however, any form of PA may be helpful to young children; one recent American study found an immediate increase in concentration levels in grades 2 to 4 following 15 minutes of stretching and walking (Caterino, M.C. & Polak, E.D., 1999). Other studies have shown that participation in PA is known to increase an individual's immediate level of arousal through an increase in neural activity in the reticular formation of the brain, although the long-term impact of this is less established (Herzholz, K., Buskies, B., Rist, M., Pawlik, G., Hollmann, W. & Hess, W. D., 1987; Hughes, C. & Graham, A., 2002; Trudeau, F. & Shephard, R.J., 2010; Welsh, M.C. & Pennington, B.F., 1988). Similarly, endurance exercise leads to a substantial increase in systemic blood pressure where the overall perfusion of the brain typically increases by 14 – 25% (Herzholz, K., Buskies, B., Rist, M., Pawlik, G., Hollmann, W. & Hess, W. D., 1987). It would appear that the intensity, duration, frequency and the nature of the tasks during PA impacts differently on an individual's potential gains with respect to their academic achievement and EF. There is

little information on the different impact that comes from different types of activity and further research is required in this specific area.

Despite discussions around the diverse nature of PA and how this may impact differently on academic achievement and EF, two consistent findings can be traced in the literature. Firstly, that increasing the time spent on PE and thus reducing the time spent on teaching academic subjects does not reduce academic achievement, and secondly, that increasing levels of PE (and PA) often results in academic achievement and EF improving suggesting that there is a link between PA and learning and behaviour. These common findings do not appear to be influenced by variability in study design or by the different measurement techniques that are cited between studies, which perhaps adds weight to the justification for increasing time allocated to PE provision in our schools. Aside from the cognitive gains that can be attributed to increasing time allocated to PE (and PA) , there is a direct link between increasing levels of PA and the general health of children (Davis, C.L. & Cooper, S., 2011).

However, there is evidence to suggest that many of the studies fail to control for known confounding variables and that we need to carefully consider these before drawing conclusions that could influence policy changes within educational curricula. For example, one particular study acknowledged that children are often not assessed clinically to exclude motor coordination difficulties and other developmental conditions that may affect their access to PA and their ability to learn (Green, L. & Francis, J., 1988; Green, L.E.N. & Francis, J., 1988). In their study Green and colleagues found that boys without a clinical diagnosis of 'Developmental Coordination Disorder (DCD)' (categorised in the study as 'probable Developmental Coordination Disorder (p-DCD)') participated in greater amounts of 'Moderate-Vigorous Physical Activity (MVPA)' per day than boys with 'Developmental Coordination Disorder (DCD)' and that fewer boys with DCD

managed to accumulate the daily recommended levels of MVPA when compared to p-DCD boys. Green and her co-authors reported that the presence of movement difficulties in children, especially boys at a young age (7 years – 12 years), is a potential risk factor for reduced MVPA. This particular limitation is supported through a similar study whose model of PA trajectories identified that motor competence may be the main limiting factor of PA in middle to late childhood (Stodden, D., Goodway, J., Langendorfer, S., Robertson, M. A., Rudisil, R. E., Garcia C., 2008).

Similarly, many studies have not taken into account the presence of cognitive deficits or specific learning difficulties in the research population, and therefore the results may show no change in academic achievement despite an increase in PA levels (Ahamed, Y., Macdonald, H., Reed, K., Naylor, P. J., Liu-Ambrose, T. & McKay, H., 2007; Green, L. & Francis, J., 1988; Green, L.E.N. & Francis, J., 1988; Muter, V., Hulme, C., Snowling, M. J. & Stevenson, J., 2004). This may be due to the presence of neuronal deficits, which would be assessed using a variety of brain imaging techniques such as 'Functional Magnetic Resonance Imaging (fMRI), Electroencephalogram (EEG) and Positron Emission Tomography (PET), where pathology exists rather than a lack of effect following periods of intervention. A failure to identify children with known confounders such as movement difficulties and/or specific learning or behavioural difficulties may jeopardise the interpretation of results. It may be argued that the scope for academic achievement and EF progressing is greatly reduced and threatens the efficacy of what may otherwise be considered an effective intervention. This is similar when considering the physiological starting point of test subjects at the beginning of the study. Physiological measures, such as body weight, Body Mass Index (BMI), daily calorie intake and sleep-wake patterns are often used in studies to measure change with some acknowledgement that many of the results achieved from these studies are confounded

by having, for example, a greater prevalence of overweight in the control group which may account for poorer academic achievement and EF (Aktop, A., 2010; Davis, C.L. & Cooper, S., 2011; Eide, E.R., Showalter, M.H., & Goldhaber, D.D., 2010). The proposed links that exist between PA and academic success then becomes increasingly tenuous and gains may be attributed to other factors.

From a social perspective, there are studies that acknowledge the impact that pre-school provision can have on academic achievement and EF in later life. Some studies have noted that pre-school enrolment has a positive effect on school readiness amongst children whose parents have a low level of education (Dang, T.T., Farkas, G., Burchinal, M.R. *et al.*, 2011; Kayili, G. & Ari, R., 2011; Ma, X., Nelson, R.F., Shen, J., & Krenn, H.Y., 2015). Alongside this, the results from a number of studies indicate children's language, cognitive and social developmental levels when they enter school are connected with their academic success (both moderately and highly correlated depending on the predictor variables used) (Hamre, B.K. & Pianta, R.C., 2001; Jimerson, S., Egeland, B. & Teo, A., 1999; Muter, V., Hulme, C., Snowling, M. J. & Stevenson, J., 2004). If the pre-school years do not provide children with a suitable start in life from a physical and mental health perspective, then according to these studies academic achievement will be greatly reduced regardless of the levels of PA the children have experienced. From a neuro-physiological perspective (connecting physical and mental health), Goswami (2008) has identified that sculpting associated with neural plasticity is largely based on the environment experienced by the child (Goswami, U., 2008). Environmental sculpting establishes specific neural pathways and networks, which will be the basis of perception, attention, learning and memory. Studies involving school-aged children and the links between PA and academic success should carefully consider what the nature of the environment has been during the children's pre-school years as well as consider the

current environment within the primary school setting. Goswami's views suggested that if the environment has consistently been, and continues to be, stimulating and secure then the child's life opportunities are enhanced providing increased potential for good physical and mental health. However, creating this suitable environment is not enough on its own. As well as the child's environment, the maturation of cognitive structures such as the frontal cortex, and the quality of the support and teaching the child receives at home and school will each have an impact on the individual's academic achievement and EF (Goswami, U., 2008). Aktop (2010) identified significant differences between low and high socio-economic status (SES) in terms of health, cognitive and socio-emotional outcomes for children with effects starting from birth and continuing throughout adulthood (Aktop, A., 2010). In his study, Aktop has identified that children from lower socioeconomic groups are less likely to be physically active and more likely to be at risk of diseases associated with physical inactivity at grades 7 and 8 (ages 12 to 14 years) when compared to children from higher socioeconomic groups. Furthermore, families from higher SES often have more success in preparing their children for school as they have, according to Aktop, wider access to a range of resources to help support their children's learning. This is a view that is shared in many studies including Eide *et al.,* (2010) where strong correlations between family background (specifically head of household education and mother's IQ) and test scores for children and adolescents were identified (Eide, E.R.*, et al.*, 2010). Taking into account the environment and nature of the activity the authors developed a novel approach to the teaching of PE with a view to maximising physical and cognitive development. This approach has been named 'Better Movers and Thinkers.'

In summary the literature suggests that increasing time allocated to PE, and increasing the levels of PA, may have a positive impact on academic achievement though further

research is required. The nature of the activities and what impact they may have requires careful consideration and evaluation. BMT aims to provide a specific approach to PE provision that targets both motor control and cognitive abilities directly in a more integrated manner and presents a novel approach to PE provision within schools.

The purpose of this present study is to identify if BMT, can positively influence academic achievement, and to identify through focus groups and interviews what the perceptions of students, staff and parents are of this innovative approach. The perceptions of these stakeholders will help to inform an understanding of the acceptability, feasibility and impact of BMT. It is anticipated, that this could help to identify attitudes to PE that the students have, and perhaps draw out conclusions of how this could influence their attitudes to maintaining a physically active life beyond the school years. This study will be placed within a 'normal' population of school children where a range of abilities is present. This manuscript describes the rationale and design for the evaluation.

3.2 Aim

The aim of this pilot study is to evaluate the efficacy and feasibility of the BMT approach to PE provision within primary school, and to investigate the perceptions of children, parents and teachers of BMT as an alternative approach to PE. The main research questions are:

- Does BMT have a different impact on academic achievement compared to traditional PE provision?
- What are the students' perceptions and experiences of PE/BMT provision?
- Is PE/BMT provision enhancing the learning and behaviour of students across the curriculum from a class teacher's perspective?

- How do the parents feel their children value PE/BMT and how does this compare to their own past experiences of PE?
- Is it feasible to introduce BMT as a novel teaching approach to PE within primary schools?

3.3 Methods/Design

3.3.1 Ethical Approval

All procedures were approved by the Local Authority and the University of Strathclyde Ethics Committees and written and informed consent was obtained from all participants.

3.3.2 Statistical Analyses

ANCOVA will be used to adjust for any pre-test differences to compare the post-intervention performance of the control condition with that of the intervention condition.

3.3.3 Power Calculation

The pilot study with its total sample size of 46 students from two intact pre-existing P6 classes would be able to detect a standardised effect size of +0.85, assuming power of .80. With the use of ANCOVA, the study should be able to detect an effect size of some +0.75 to +0.85.

3.3.4 Study Design

The study will involve two mainstream state schools, the Primary 6 (P6) students (aged 9 – 11 years) in one school acting as the control condition and the P6 students in the other school acting as the intervention condition. The design of the study is a 16-week intervention with pre- and post- measurements taken from two standardised assessments

(one physical and one academic) gathering quantitative data. At the end of the 16-week intervention phase 2 focus groups will be conducted separately for students (approx. 10 students in each) in both schools. Parents will be sent a letter asking for their view and blank postcards will be provided to encourage their involvement. Finally, one-to-one interviews, lasting approximately 20 – 30 minutes will be conducted with each of the class teachers. The focus groups, postcards and interviews will be analysed qualitatively.

3.3.5 Recruitment Procedures

A letter was sent to the Education Development Officer of a Local Authority (LA) outlining the rationale, methods and procedures of the research, seeking permission to involve two primary schools within the LA which was received in November 2011. Two primary schools were then identified on the basis of having comparable class sizes, levels of attainment and catchment areas (the schools are located approximately one mile from each other within the LA). Two substitute schools were also identified though were not required as both original schools gave their consent from the outset.

Having identified the two schools, letters were sent to the head teachers of both primary schools outlining the research and seeking permission for their involvement. This was followed-up, one week later, with a phone call where a meeting was arranged between the main researcher, a representative from the Learning and Leisure Services within the LA and the head teacher to explain the research in more detail and provide the head teacher with opportunities to raise any specific questions. Both head teachers agreed to their involvement and parental consent forms were issued to each of the children within the control and intervention conditions and returned to the school. The principal researcher attended a separate meeting with each P6 class outlining the nature of the research study and to explain what the student involvement would be. Students were

provided with an information sheet at the same time. Questions that arose were answered before students were provided with assent forms to complete and sign if they wished to be involved in the pilot study.

P6 students were selected as neurologically there is a considerable pruning stage that occurs between the ages of 6 ½ and 8 years (Eliot, L., 1999), and the average onset of the pubescent stage of life in Scotland is 11 years for girls and 12 years for boys (National Health Service, 2016). Therefore, selecting P6 students provided the most stable base to take into account some of the other variables that are known to impact on performance during this study. Whilst this helps to take some account of the processes of maturation, there may be some students who start puberty at an earlier age. This will naturally impact on any generalisability that can be drawn across population from the findings.

3.3.6 Study Sample

In the control condition, students (n=23) who provide assent will be involved though the data collected for 2 students will be excluded from the study at the request of the head teacher at the initial meeting. In the intervention condition, students within the intervention condition P6 class (n=25) who provide assent will agree to be involved throughout the study with no exemptions being outlined. At the beginning and throughout the study all parents and students were provided with the opportunity to opt out of the study without reason or justification.

3.3.7 Primary Outcome Measures

Movement Assessment Battery for Children-2 (MABC2) (Henderson, S.E., Sugden, D. A. & Barnett, A. L., 2007)

Balance Subtests

Three balance subtests (One Board Balance, Walking Heel-to-Toe Forwards and Hopping on Mats) were taken from the MABC2 to evaluate the movement and balance competency of each student. This will help to identify any student with a movement difficulty prior to the start of the intervention phase. The procedures and scoring process associated with the MABC2 can be found in the instructor's manual associated with this particular assessment tool (Henderson, S.E., Sugden, D. A. & Barnett, A. L., 2007).

Reliability and Validity

Studies reveal has inter-rater or test-retest reliability in the range 0.53 to 0.95 (Chow, S.M.K., & Henderson, S. E., 2003; Croce, R.V., Horvat, M. & McCarthy, E., 2001) that the MABC2. For example, as part of the standardisation of 'Movement ABC,' its relationship with the first edition of the 'Bruininks-Oseretsky Test of Motor Proficiency (BOT)' (Bruininks, R.H., 1978) was examined.

LASS 8 – 11 (Lucid Assessment System for Schools) (Singleton, C., 2007)

The complete assessment programme will be undertaken by each student in both schools. The assessment entails 8 subtests with each test assessing a different component (see Table 3.1). The students in each school will go through the subtests in the prescriptive order as outlined in the procedures of the LASS 8 – 11 assessor's manual (Singleton, C., 2007). As this assessment is a computer-based assessment raw scores achieved by each student will be immediately converted into a range of scores that include a raw score, centile, Z-score, Z-score difference and age-equivalent score. For the purpose of this study, the Z-score will be used as the outcome measure as this provides the most accurate measurement outcomes when dealing with individual extremeness in results.

Reliability and Validity

Studies reveal (Singleton, C., 2007) that the LASS 8 - 11 has inter-rater or test-retest reliability in the range 0.51 to 0.93. For example, one study investigated the test-retest reliability of LASS using 101 students (55 boys and 46 girls) aged between 11 years 6 months and 15 years 11 months. The sample had been randomly selected from year 7 to year 11 registers in seven different schools in different regions of England and Scotland. The students were tested on LASS 11 - 15 and then re-tested 4 weeks later and the results showed that in all cases, significant test-retest correlation were obtained indicating satisfactory test-retest reliability.

Table 3.1: Subtest name, category, type and description for LASS 8 - 11

TEST	CATEGORY	TYPE	DESCRIPTION
Sentence reading	Attainment	Adaptive	Completing sentences by identifying the missing word from a choice of five alternatives. No spoken assistance is given.
Single word reading	Attainment	Adaptive	Identifying from a choice of five alternatives the printed word that corresponds to a spoken word.
Spelling	Attainment	Adaptive	Spelling individual real words that are spoken by the computer.
Reasoning	Ability	Adaptive	Analogical reasoning where the correct item from a choice of six alternatives has to be selected in order to complete a spatial matrix.
Mobile Phone	Diagnostic	Progressive	Recall of between two and nine digits in correct (forwards) sequential order.

TEST	CATEGORY	TYPE	DESCRIPTION
The Haunted Cave	Diagnostic	Progressive	Immediate recall of objects and their spatial positions, beginning with two items and progressing to seven items.
Funny Words	Diagnostic	Adaptive	A pure measure of phonic decoding skills. For each nonword there is a choice from four spoken alternatives.
Word Chopping	Diagnostic	Adaptive	Segmentation and deletion of syllables and phonemes in real words. For each item there is a choice from four spoken alternatives.

3.3.8 Procedures

Students will receive an information presentation about the study from the main researcher providing them with an opportunity to ask questions about the study. The students will be provided with an information sheet at the same time as the presentation before being handed an assent form for them to sign indicating that they agreed to participate in the study. The students will also receive an information sheet and consent form for their parents to sign provided that the parents/guardians wish their child(ren) to be involved in the study. This will be collected from the school by the main researcher the following day.

Pre-testing will be conducted on a one-to-one basis with the main researcher and will take place within a quiet room within the school. Physical testing using the 'MABC2' test will be carried out with each student, before completing the 'LASS 8 – 11' with each

student on a separate day. Throughout the testing no verbal or non-verbal feedback will be provided. Each student will be thanked by the main researcher on completion of the testing and will be told that they will be tested again at the end of the intervention phase.

The Intervention

Both schools agreed to provide two 55-minute sessions of PE each week, for 16 weeks commencing on 17th January and concluding on 24th May 2012. Most of the sessions will take place on Monday and Thursday mornings in the control condition and Tuesday and Thursday mornings in the intervention condition. The control condition will receive their provision from a combination of both the PE specialist and the class teacher, and would traditionally cover a range of activities. The PE specialist and class teacher are unaware of the nature and content of BMT sessions throughout the pilot study. The class teacher was aware of the study design and method.

The intervention condition will receive their provision from two PE specialists who have been intrinsically involved in the development and design of BMT from its conception. Each of these PE specialists will take one session per week, and both will liaise with one another each week in order to discuss how the students were performing and to establish the focus of subsequent sessions.

To quality assure the fidelity of delivery of the intervention the main research supervisor will observe two sessions of BMT; one for each of the two specialists responsible for delivering the BMT sessions. The fidelity of the control condition will be done by the main researcher observing a session of delivery from the PE specialist and the class teacher.

BMT sessions have been provided across a range of schools and throughout a range of ages within the authority prior to this pilot study, and in essence it is from the analytical

feedback and interest of staff and students involved that this pilot study has been designed. The schools, staff and students involved in the study had not witnessed or received any BMT intervention prior the beginning of the pilot study.

Control

Traditional practices in PE, PA and sport primarily focus on the teaching of discipline specific skills (kicking a football or passing a netball for instance), perceiving that the acquisition of these skills has value to the learner across the curriculum. Traditional practices do not directly involve the development of thinking skills as a specific outcome but is primarily concerned with the skill level and performance of the learner towards specific goal-directed actions. Both the control condition and the intervention condition will be receiving the PE curriculum specified by Curriculum for Excellence (Scottish Executive, 2004a).

3.3.9 Qualitative Study

Focus groups have been chosen as they *"...are very focused on a particular issue and, therefore, will yield insights that might not otherwise have been available in a straightforward interview....producing a large amount of data in a short period of time."* (Cohen, L., Manion, L., & Morrison, K., 2011)

Students will be offered the opportunity to participate in focus groups (3 for both the control and experimental schools, each having approximately 8 students taking part at any one time) at the end of the study. The number of participants within each focus group is based upon recommendations in the literature where it is indicated that one of the issues to be addressed in running focus groups is deciding the size of the groups (Fowler, F.J., 2009; Morgan, D.L., 1997). Too small and intra-group dynamics exert a

disproportionate effect, too large and the group becomes unwieldy and hard to manage; it fragments.

The following three areas will be covered:

1. The enjoyment levels of the students during the PE lessons
2. Student perceptions on what they learned in the PE lessons
3. Transferable skills from PE lessons to classroom-based learning

The enjoyment levels of the students during their PE lessons

The students will be provided with a visual prompt (i.e. a photograph of a happy group of children along with a photograph of an unhappy group of children) before the following questions are presented:

- Tell me about the activities you enjoyed during your PE lessons from January to May this year?
- Can you give me some examples of these activities and tell me why you enjoyed them?
- Tell me about the activities you did not enjoy during your PE lessons from January to May this year?
- Can you give me some examples of these activities and tell me why you did not enjoy them?

Student perceptions on what they learned during their PE lessons

The students will be provided with a visual prompt (i.e. a picture of a child in a learning context) before the following questions are presented:

- What did you learn in your PE lessons from January to May this year?
- Can you give me an example of the activity you were doing when you learned this?
- How did you feel when you were learning this?

Transferable skills from PE lessons to Classroom-based learning

The students will be provided with a visual prompt (i.e. a picture of a child measuring the long jump along with a picture of a child measuring the side of a square) before the following questions are presented:

- Do you think there are activities you learn in PE that have helped you learn in the classroom?
- Can you give me an example of this?

Parents will be offered the opportunity to offer their perceptions (a letter and blank postcard will be sent) at the end of the study. This will be offered to all parents and the topics that will be covered include:

1. What were the parent's experiences of PE lessons when they were at school?
2. How different do they think the PE lessons are at school now compared to their past experiences?
3. What do your children think about PE lessons?
4. How do you think they value their PE lessons?
5. What value do you place on your children's PE lessons?

Class teachers from both the control group and the experimental group will be offered an interview at the end of the study. The topics to be covered will include:

1. What differences were identified in classroom behaviour prior to and after the BMT/PE sessions (i.e. better attention and concentration)
2. Was there a change in school attendance on the days that BMT/PE sessions were being delivered?
3. What links existed between the BMT/PE sessions and the classroom?

One-to-one interviews have been chosen as *"Interviews enable participants to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view."* (Cohen, L., Manion, L., & Morrison, K., 2011)

The focus groups and classroom teacher interviews are carried out by a research team assistant who is not involved in the quantitative testing protocols or in the delivery of any of the PE/BMT lessons within the control or experimental group. The research assistant specialises in the facilitation of focus groups and is a member of the University of Strathclyde teaching team.

Setting

The PE/BMT sessions were conducted within the gym facilities at the schools. Quantitative data were gathered within a quiet room within the school on a one-to-one with the main researcher and the qualitative data were gathered within the same room in the presence of the research team assistant.

Data Management

Quantitative data will be entered into an SPSS Data file and stored in a secure network drive. Qualitative data will be audio-recorded, transcribed verbatim and anonymised. Digital copies of the transcribed data from the student focus groups, the parent feedback forms and the class teacher interview transcripts will be kept in a secure cabinet.

3.3.10 Data Analysis

Quantitative Data

Baseline data collection will be completed prior to the start of the intervention phase. Inferences about the effect of the PE and BMT sessions will be made from comparisons between group measurements at baseline and at the end of the 16 week intervention phase.

Movement ABC2

The data collected from the three subtests are taken as a raw score which is transferred into a standard score using a conversion table. The accumulated standard scores are then converted into a composite standard score and percentile. For the purposes of data analysis within this study, the composite standard score will be used for comparison.

LASS 8 - 11

This is a computer-based assessment tool and automatically records and presents the performance of each of the 8 subtest into raw score, centile, z-score, z-score discrepancy and age equivalent data. For the purposes of comparing results from baseline to those at the end of the 16 week intervention, the z-score data will be used for each subtest.

Qualitative Data

Focus groups and class teacher interviews will be conducted by an independent researcher who has an expertise in this particular area of qualitative data collection. The focus groups and class teacher interviews will be recorded using audio-recording equipment

and the main researcher will then provide a verbatim transcription that will then be analysed thematically.

3.4 Discussion

The pilot study will examine the impact that BMT has on academic achievement; student; parent, and class teacher perceptions in comparison to traditional PE provision. This paper provides the details of the rationale and design of the study and details of the intervention, outcome measures and the recruitment process. Effect sizes derived from comparison between the intervention and control groups from the pilot study will provide information on the feasibility of delivering BMT as an alternative PE provision within primary schools and inform a power and sample size calculation for a larger-scale study. The study will address evidence gaps in current research: a) the need for a Scottish based study into the links between PA and academic achievement; b) how feasible is it to provide BMT sessions as an alternative to traditional PE provision; c) how the nature of the activities provided during traditional PE and BMT impact differently on academic attainment; and d) different experiences and perceptions of PE/BMT sessions from participants within this study.

3.4.1 Strengths

The study could identify an alternative teaching method that helps to provide quality PE provision for all primary school-aged students whilst identifying cross-curricular links between PE, PA and sport and other areas of the curriculum. The perceptions of the participants may provide interesting insights that help identify effective strategies that further encourage the government's health agenda and helps get more children within Scotland active on a daily basis. Children from both the control and experimental groups come from a range of socio-economic backgrounds. Finally, the primary outcome

measures used in this study are standardised test scores which minimise observer bias. Similarly, the main researcher is involved in the gathering of the quantitative data but not the qualitative data and will not be involved in the delivery or evaluation of any of the PE/BMT sessions.

3.4.2 Limitations

There are many variables that can be attributed to the differences in outcome measures. It has not been possible to control for all of these variables within this pilot study. The small number of participants and the short length of time of the study as well as a current lack of qualified teachers who are able to provide BMT sessions limit this study. An analysis of current levels of activity both within and outside the school setting was not identified prior the start of the pilot study yet these are crucial areas that would further enhance this study design (Coe, D.P*., et al.*, 2006; Trudeau, F. & Shephard, R.J., 2010). Students from both schools were not measured using Body Mass Index (BMI) prior to the start of this pilot study despite previous studies highlighting the impact that these can have on academic outcome (Aktop, A., 2010; Davis, C.L. & Cooper, S., 2011; Eide, E.R*., et al.*, 2010). No information was gathered about the pre-school provision of the students prior to the start of this study. As this study accounts for only 46 P6 students within one authority, it is difficult to generalise any findings to a wider population. However, it does provide an insight into potential future studies of this kind.

CHAPTER 4: BETTER MOVERS AND THINKERS (BMT): AN EXPLORATORY STUDY OF AN INNOVATIVE APPROACH TO PHYSICAL EDUCATION

One article has been published from the findings of this study (Dalziell, A., Boyle, J., & Mutrie, N., 2015b).

4.1 Introduction

Recent research has reignited interest into the physical and cognitive benefits of physical activity (PA) with some studies specifically highlighting beneficial aspects of activity on Executive Functioning[2] (Blair, C., & Razza, R. P., 2007; Coe, D.P.*, et al.*, 2006; Diamond, A. & Lee, K., 2011; Trudeau, F. & Shephard, R.J., 2010). Recent research has suggested plausible links between PA and the enhancement of EF including; physiological influences such as greater cerebral blood flow; increased secretion of neurotrophins as a result of increasing levels of PA; psychological influences such as an increase in self-esteem and a desire to learn and be part of the school (Ahn, S. & Fedewa, A.L., 2011; Strong, W.B., Malina, R.M., Blimkie, C.J.R. *et al.*, 2005; Trudeau, F. & Shephard, R.J., 2010). Other studies have identified that no decrease in academic performance has been observed despite a curtailing of time spent teaching academic subjects in favour of more time participating in PE (Ahamed, Y., Macdonald, H., Reed, K., Naylor, P. J., Liu-Ambrose, T. & McKay, H., 2007; Trudeau, F. & Shephard, R.J., 2010). Aside from the cognitive gains that can be attributed to increasing time allocated to PE (and consequently being physically active), there is a well-established link between increasing levels of PA and the general health of children (Ahn, S. & Fedewa, A.L., 2011; Kristensen, P.L., Moeller, N.C., Korsholm, L. *et al.*, 2010).

[22] For an explanation of Executive Functioning please refer back to the previous chapter, page 25.

Studies have investigated the impact of gentle, vigorous and chronic bouts of exercise on academic performance (Coe, D.P.*, et al.*, 2006; Davis, C.L. & Cooper, S., 2011). One study carried out in the United States reported an immediate increase in concentration levels in grades 2 to 4 following 15 minutes of stretching and walking (Caterino, M.C. & Polak, E.D., 1999). Whilst this demonstrates a positive impact between the engagement in PA and concentration levels, the activities carried out in this study are not normally part of a PE lesson and lasted for a much shorter duration. Other larger-scale studies (Hamre, B.K. & Pianta, R.C., 2001; Hughes, C. & Graham, A., 2002; Welsh, M.C. & Pennington, B.F., 1988) have shown that being physically active is known to increase an individual's immediate level of arousal through an increase in neural activity in the reticular formation of the brain, although the long-term impact of this increase is less established (Biddle, S.J.H. & Asare, M., 2011). Similarly, endurance exercise (a sustained period of running and swimming, for example) leads to a substantial increase in systemic blood pressure where the overall perfusion of the brain typically increases by 14 – 25% (Goswami, U., 2008; Hamre, B.K. & Pianta, R.C., 2001). It would appear that the intensity, duration and frequency of PA may impact differently on an individual's potential gains with respect to their academic achievement. There is little information on the different impact that comes from different modes of activity and further research is required in this area.

Despite discussions around the diverse nature of PA and how this may impact differently on academic achievement, the literature reveals two related findings. Firstly, that increasing the time spent on PE and thus reducing the time spent on teaching academic subjects does not reduce academic achievement, and secondly, that when students are more physically active, this can often be associated with improvements in their academic achievement suggesting that there may be a link between PA and learning. These findings

seem to correlate and do not appear to be influenced by variability in study design or by the different measurement techniques that are cited between studies, perhaps adding weight to the justification for increasing time allocated to PE provision in our schools.

Research further reveals divergent findings regarding the relationship between gender and academic achievement with some evidence favouring boys and some evidence girls (Hyde, J.S., 2005; Machin, S., & Pekkarinen, T., 2008). Other authors note that historically boys were largely advantaged in the school classroom and most academic settings (Matthews, J.S., Ponitz, C. C. & Morrison, F. J., 2009; Weaver-Hightower, M., 2003). Other studies, however, reveal that girls tend to build better relationships with their teachers, attain higher results, achieve higher levels of education and generally progress scholastically better when compared with boys (Duckworth, A., & Seligman, M. E., 2006; Ready, D., Logerfo, L., Burkham, D. T. & Lee, V. E., 2005; Silverman, I.W., 2003). However, within these studies there is a clear differential effect between gender depending on the subject being assessed and the nature of that assessment. The literature indicates a significant advantage for girls in language based tasks (Duckworth, A., & Seligman, M. E., 2006) and an advantage for boys in standardised tests that may be based on their motivation within a competitive environment being greater than girls (Gneezy, U., Niederle, M., & Rustichini, A., 2003). One of the plausible causes underpinning these gender differences is that strong behavioural regulation developed in the earlier years in the school sets precedence for successful academic achievement through increased school engagement and motivation (Fredericks, J.A., Blumenfeld, P. C. & Paris, A. H., 2004; Zimmerman, B.J. & Schunk, D.H., 2011) and studies have shown that girls are able to regulate their behaviours earlier than boys (Fredericks, J.A., Blumenfeld, P. C. & Paris, A. H., 2004; Zimmerman, B.J. & Schunk, D.H., 2011). To varying degrees, self-regulation tasks tap EF such as attention and inhibitory control which, according to some

researchers, support self-directed classroom behaviours (Blair, C., 2002; Brook, U. & Boaz, M., 2005; Howse, R.B., Lange, G., Farran, D. C. & Boyles, C. D., 2003; Ponitz, C.C., McClelland, M. M., Jewkes, A. M., Connor, C. M., Farris, C. L. & Morrison F. J., 2008; Saracho, O. & Spodek, B., 2007). Deficiencies in self-regulation present at a younger age may undermine academic achievement and predict outcomes (Green, L. & Francis, J., 1988; Green, L.E.N. & Francis, J., 1988; Vitaro, F., Brendgen, M., Larose, S. & Tremblay, R. E., 2005) with one study suggesting that there is a particular link between inhibitory control (for example, delayed gratification, impulse control) and phonological awareness (for example, blending and segmenting of sound components and syllables within written and/or oral tasks)(Blair, C., & Razza, R. P., 2007). This particular finding is of considerable relevance as research has shown that blending and segmentation of sounds and phonics has the greatest transfer to emergent reading and spelling (Ehri, L.C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z. & Shanahan, T., 2001). Phonological awareness is known to develop earlier in girls with concomitant findings demonstrating that girls are better readers than boys (Machin, S., & Pekkarinen, T., 2008). It would appear from other studies that this phenomenon may be universal and the result from large-scale international comparisons of reading literacy among 10-year olds and 15-year olds also showed that girls read better than boys in a wide variety of school systems and cultural settings (Chiu, M.M., & McBride-Chang, C., 2006; Machin, S., & Pekkarinen, T., 2008).

In summary, if time spent in PE enhances EF through participation and engagement in physical activities, then this in turn may lead to better levels of inhibitory control and attention which have been directly linked to phonological awareness. The levels of enhancement and progress may differ between boys and girls.

Historically, a common approach to PE for primary age children typically involves a skills-based session which is often teacher-led (Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R., 2009). An alternative approach has been developed which directly involves a shift in pedagogical practice where sports and other activities are used as a vehicle to develop three key constituent parts: thinking skills (decision making, problem solving, adaptability, working memory), human capacities (determination, perseverance, self-confidence) and physical literacy with no instruction provided with regards to the development of technical skills (see Fig. 4.1). This approach consciously directs a specific focus towards the inclusion of EF skills and sets out to identify if this different approach to teaching primary PE can lead to improvements in academic achievement.

'Better Movers and Thinkers (BMT)' is designed to develop the ability to move and think in an integrated way within PE. Exponents of BMT contend that if children have better quality and control over their balance and movements, this can then become more automatic potentially resulting in reduced levels of conscious thought having to govern movement and balance. To coincide with this development, EF have been specifically developed through the BMT approach, assisting the development of cognitive processes, which in turn will help them, succeed across the curriculum (Diamond, A*., et al.*, 2007). There have been many studies identifying the impact of good EF skills in children but there are no studies that have used PE as the context for learning (Booth, J.N*., et al.*, 2013; Diamond, A. & Lee, K., 2011; Koziol, L.F. & Lutz, J.T., 2013; Monette, S., Bigras, M., & Guay, M.-C., 2011). The present study therefore acts as an exploratory study into the possible links between PE and EF skill development leading to educational gains. Figure 4.1 represents the BMT learning framework that encompasses the three constituent parts that come together to make performance. Physical literacy focuses on the development

of key physical attributes that enhance physical performance such as balance, postural control, gross motor coordination, rhythm and timing. Personal qualities relate to aspects of human characteristics such as determination, courage, motivation and perseverance which are considered by the proponents of BMT to be essential to remain engaged with the process of learning. Thinking skills refers to the development of cognitive processes such as the development, enhancement and refinement of EF skills. Figure 4.2 represents the BMT process that should occur in each individual session where there is the identification of the series of movement skills to develop physical literacy, the inclusion of a series of differentiated cognitive tasks to develop thinking skills, a specific focus on integrating and developing EF skills and encouraging the active engagement of the learner through the development of personal qualities.

Figure 4.1: The Learning Framework

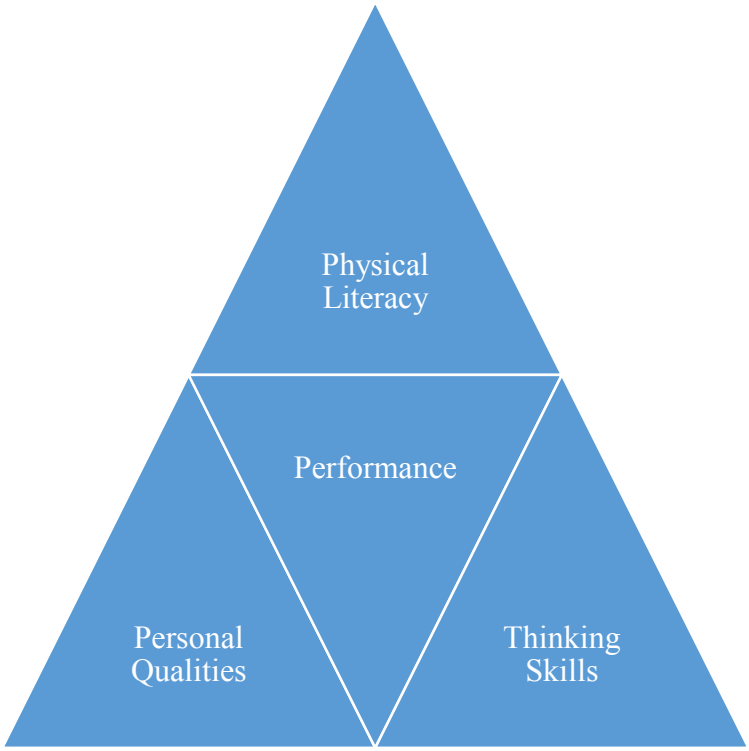
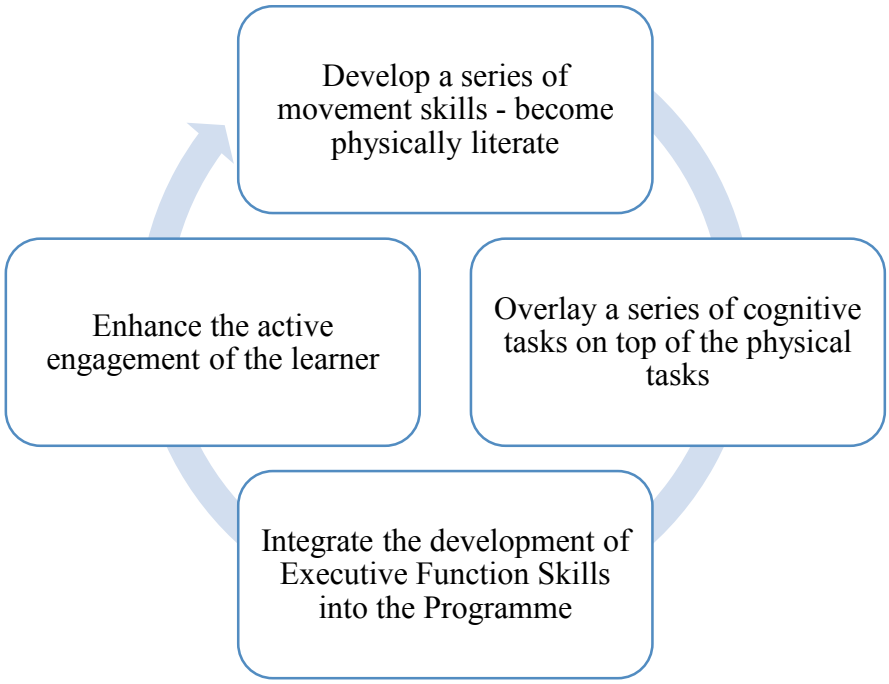


Figure 4.2: The BMT Process



The purpose of this study was to evaluate if BMT positively influences academic skills, and to identify what the perceptions of students and staff are of this approach within primary education. The perceptions of these stakeholders will help to inform an understanding of the acceptability, feasibility and impact of BMT in the delivery of PE within the primary school.

4.2 Methods

4.2.1 Design

A mixed methods design utilising both quantitative and qualitative data was adopted for this study to provide information about the efficacy, acceptability and feasibility of BMT as an approach to delivering PE in primary schools (Denscombe, M., 2008).

4.2.2 Participants

Participants in this study were aged 9 – 10 years and were attending two mainstream state schools in a Primary 6 class in Scotland, UK. Following ethical approval by the University of Strathclyde and the local authority, two schools were recruited with one hosting the intervention and the other one serving as a control. The schools were identified as being similar in terms of school roll, school facilities and were within close proximity (i.e. less than one mile) from one another. Once the schools were identified the selection of which schools acted as the control and which acted as the intervention was decided by the Quality Improvement Officer (QIO) representing the local authority. Parents provided informed consent and students provided informed assent for participation and had the opportunity to opt out of the study. There were 21 students (9 boys and 12 girls) in the control condition, and 25 students (13 boys and 12 girls) in the intervention condition.

4.2.3 Materials

Movement Assessment Battery for Children-2 (MABC2) (Henderson, S.E., Sugden, D. A. & Barnett, A. L., 2007)

Balance Subtests

Three balance subtests (One Board Balance, Walking Heel-to-Toe Forwards and Hopping on Mats) were taken from the MABC2 to evaluate the movement and balance competency of each child. These 3 subtests were taken from the test due to the pragmatic limitations of running a study within school and limited access and time not being available to utilise the full scale test. Studies reveal that the MABC2 has test-retest reliability in the range .53 - .95 (Croce, R.V., Horvat, M. & McCarthy, E., 2001). The balance composite score has a high reliability ($\alpha = .90$) when measuring internal consistency using Cronbach's alphas.

Lucid Assessment System for Schools (LASS 8 – 11) (Singleton, C., 2007)

LASS 8 - 11 consists of 8 subtests each of which assesses a different measurable component within the three categories; EF, academic skills and non-verbal intelligence (see Table 1). The complete LASS assessment programme was undertaken by each child in both schools. The children in each school went through the subtests in the prescriptive order as outlined in the procedures of the LASS 8 – 11 assessor's manual (Singleton, C., 2007). Z-scores were transferred into T-scores by the main researcher and used as the outcome measure to allow for a comparison to be made between conditions. The Working Memory composite score consisted of 2 items ($\alpha = .61$), the Reading composite consisted of 2 items ($\alpha = .28$) and the Phonological composite consisted of 2 items ($\alpha = .44$). This

demonstrates a moderate reliability for Working Memory, and low reliability for Phonological composite and Reading composite.

Studies reveal that the LASS 8 - 11 has test-retest reliability in the range .51 - .93. This range suggests that the reliability of the assessment tools rates from fair to excellent and is suitable for this exploratory study (Cicchetti, D.V., 1994; Cicchetti, D.V., & Sparrow, S. S., 1981; Fleiss, J.L., 1981).

Table 4.1: Subtest name and test area for LASS 8 – 11

Subtest Name	**Test Area**
Cave	Visual spatial memory
Mobile Phone	Auditory sequential memory (digit span)
Non-Words	Phonological Awareness
Segments	Phonological decoding and encoding
Single-Word Reading	Sight word reading
Sentence Reading	Cloze reading
Spelling	Spelling
Reasoning	Non-verbal reasoning intelligence

4.2.4 Procedures

Both schools agreed to provide two 60-minute sessions of PE each week, for 16 weeks commencing on 17th January and concluding on 24th May 2012. Most of the sessions took place on Monday and Thursday mornings in the control condition and Tuesday and Thursday mornings in the intervention condition. The control condition received their standard PE provision where the class teacher was supported in the delivery of PE by a PE specialist, with strategic input from National Governing Body (NGB) sports coaches. The students covered a range of activities such as team sports and gymnastics. The PE

specialist, sports coaches and class teacher were unaware of the nature and content of BMT sessions throughout this study. The class teacher was aware of the study design and method.

The intervention condition received the BMT provision from two PE specialists who have contributed to the development and design of BMT from its conception. Each of these PE specialists took one session per week, and both liaised with one another each week in order to discuss how the students were performing and to establish the focus of subsequent sessions.

Quantitative Data

Pre and post-testing was conducted on a one-to-one basis by the main researcher and the students in both schools. Physical testing using the MABC2 was carried out with each student, in a quiet room within the school before completing the LASS 8 – 11 with each student on a separate day in the same quiet room. All testing was completed in December prior to the intervention commencing in January.

Qualitative Data

The focus group (inclusive of 8 randomly selected students, 4 boys and 4 girls) and classroom teacher interview were carried out by a research team assistant who was not involved in the quantitative testing protocols or in the delivery of any of the PE/BMT lessons within the control or intervention condition. The research assistant was an experienced interviewer and facilitator of focus groups.

The following three areas were covered in the student focus group:

1. The enjoyment levels of the students during the PE lessons
2. Student perceptions on what they learned in the PE lessons

3. Transferable skills from PE lessons to classroom-based learning

These three areas were selected as they would inform the study about the experience the students had of BMT, and would provide an insight into the links between BMT and aspects of learning as perceived by the students. This would help to further inform the efficacy and feasibility of adopting BMT as an alternative approach to PE.

The class teacher participated in an interview at the end of the study. The topics covered included:

1. Differences in classroom behaviour prior to and after the BMT/PE sessions (i.e. change in attention and concentration)
2. Changes in school attendance on the days that BMT/PE sessions were being delivered?
3. Cross-curricular links between BMT/PE and classroom learning?

4.2.5 Data Analysis

Quantitative Data

Baseline data collection was completed prior to the start of the intervention phase and post-testing was completed within 2 weeks of the intervention phase ending. Statistical analysis was undertaken by analysis of covariance (ANCOVA) using SPSS version 19 with baseline scores as covariate.

Movement ABC2

Raw data from the three subtests were transferred into standard scores using a conversion table. Analyses here are based on the composite standard scores following the outlined

procedures of the MABC2 assessment (Henderson, S.E., Sugden, D. A. & Barnett, A. L., 2007).

LASS 8 - 11

This is a computer-based assessment tool and automatically records and presents the performance of each of the 8 subtest into raw score, centile, z-score, z-score discrepancy and age equivalent data. For the purposes of comparing results from baseline to those at the end of the 16 week intervention, the z-scores were transformed into *t*-scores for each subtest using the formula; $T = (Z\ score \times 10) + 50$

The working memory composite score was calculated by adding the *T*-score from the visual spatial memory subtest (i.e. Cave) to the *T*-score from the auditory sequential memory subtest (i.e. Mobile Phone) to produce an average score. Similarly, a composite score for the phonological skills was calculated by adding the *T*-score from the phonological awareness subtest (i.e. Non-Words) to the phonological decoding and encoding subtest (i.e. Segments). A composite score for reading was calculated by adding the *T*-score from the sight word reading subtest (i.e. Single Word Reading) to the cloze reading subtest (i.e. Sentence Reading) producing an average score. Composite scores were calculated using the following expression: composite = $T\text{-}score + T\text{-}score/2$

Qualitative Data

The first author transcribed the focus groups and class teacher interviews verbatim before analysing the results. Themes were informed by the research questions and subthemes emerged from the data. Illustrative quotes from the respondents were used to illuminate the categories. To ensure participant anonymity, pseudo names were used throughout the transcription and in the reporting of results.

4.3 Results

21 students (9 boys, 12 girls) participated in the control condition and 25 students (13 boys, 12 girls) in the intervention condition. All of the participants presented full data for both pre- and post-test conditions.

4.3.1 Quantitative Data

MABC2

The results from the three subtests administered revealed a ceiling effect. The highest score achievable was 19, and all students met the criteria for this score in accordance with the procedures as laid out in the assessment manual. Findings from these subtests will not be further reported.

LASS 8 – 11

Significant main effects for the intervention condition were revealed by the ANCOVA for the Working Memory Composite score ($F(1,41) = 4.52$, $p = .040$), the Phonological Composite score ($F(1,41) = 4.43$, $p=.042$), and the 'Segments' subtest ($F(1,41) = 6.63$, $p = .014$). No significant main effects were identified for Reading Composite ($F(1, 41), = 1.74$, $p = .195$) or Reasoning ($F(1, 43) = 0.92$, $p = .390$) subtests or for Spelling, although the latter approached significance ($F(1, 41), = 3.00$, $p = .091$).

Table 4.2 shows the means and standard deviations for the computer-based assessment system LASS 8 – 11 for the control and intervention condition participants.

Table 4.2: Means and standard deviation (SDs) for working memory composite, phonological skills, Reading composite, spelling and reasoning for intervention and control conditions pre- and post-test.

	Mean scores (SD) at Pre-Test		Mean scores (SD) at Post-Test	
Outcome Measures	Control	Intervention	Control	Intervention
Working Memory	54.45 (8.22)	55.92 (5.53)	55.54 (9.41)	56.13 (5.88)
Phonological Skills	49.18 (7.56)	48.19 (7.17)	49.34 (7.07)	50.72 (6.06)
Reading Composite	58.53 (7.48)	54.04 (10.37)	51.18 (6.58)	50.64 (6.35)
Spelling	52.51 (6.97)	50.79 (7.25)	51.32 (6.50)	51.82 (6.27)
Reasoning	46.63 (7.62)	43.64 (5.67)	46.75 (7.93)	47.00 (6.15)

There were significant group by gender interaction in the case of the Phonological Composite Scores ($F(1,19) = 9.85$, $p = .005$), the 'Segments' subtest ($F(1, 19), = 10.48$, $p = .004$), and 'Spelling' ($F(1, 19) = 10.97$, $p = .007$) with boys in the intervention condition achieving significantly higher scores than boys from the control condition in all three measures. Table 4.3 shows the means, standard deviations and p-values for the computer-based assessment system LASS 8 – 11 for both conditions by gender.

Table 4.3: Boys and girls means, standard deviation (SDs) at Pre- and Post-testing for control and intervention conditions pre- and post-test.

		Mean Scores (SD) at Pre-Test		Mean Scores (SD) at Post-Test		
Outcome Measures		Control	Intervention	Control	Intervention	*p*-Value
Working Memory	Boys	56.20 (8.56)	57.16 (3.92)	53.57 (10.95)	57.92 (5.46)	.207
	Girls	53.14 (8.06)	54.59 (6.80)	57.02 (8.26)	54.19 (5.91)	.129
Phon^ Composite	Boys	48.14 (7.62)	50.85 (5.53)	45.95 (6.07)	52.50 (3.42)	.005*
	Girls	49.96 (7.75)	45.31 (7.84)	51.88 (6.91)	48.80 (7.73)	.705
Non-Words	Boys	50.02 (9.05)	49.30 (8.27)	47.60 (5.58)	50.27 (3.86)	.201
	Girls	48.69 (9.64)	44.74 (7.53)	52.79 (8.26)	49.94 (9.39)	.597
Segments	Boys	46.25 (7.70)	52.40 (8.58)	44.31 (8.08)	54.73 (5.56)	.004*
	Girls	51.23 (10.85)	45.87 (10.07)	50.97 (7.71)	47.66 (8.54)	.547
Read Composite	Boys	58.76 (5.40)	52.95 (10.22)	48.82 (6.35)	51.30 (5.78)	.351
	Girls	58.36 (8.97)	55.22 (10.85)	52.94 (6.44)	49.93 (7.11)	.456
Spelling	Boys	50.69 (5.63)	52.06 (5.28)	48.56 (4.69)	53.36 (2.84)	.007*
	Girls	53.87 (7.78)	49.41 (8.97)	53.40 (7.06)	50.16 (8.43)	.813
Reasoning	Boys	44.89 (4.77)	44.79 (6.14)	43.83 (7.48)	47.39 (6.18)	.248
	Girls	47.93 (9.20)	42.40 (5.07)	48.94 (7.85)	46.48 (6.36)	.713

* $P = <.05$

4.3.2 Qualitative Data

Students Theme 1 – Enjoyment Levels

Three sub-themes emerged from the analysis of the student's perceptions of enjoyment of BMT: rules adherence, pedagogy, and perceived self-competence. The respondents felt that student enjoyment levels were enhanced if everyone in the class adhered to the

rules of the task or activity. The respondents were also clear that if rules were not adhered to that this increased levels of frustration and prevented a successful experience of BMT:

"It was really annoying because every time you were with a partner, like some of the partner, well one of my partners was really annoying and he wouldn't actually do it and then when you got round to doing it he couldn't actually remember what you were supposed to do." (Calvin)

Students commented on the teaching approaches adopted by the teachers, suggesting that the pedagogy used by the staff helped to enhance the student's experience of BMT and enriched their enjoyment of the subject.

".. it's good cause, when you do the patterns with your partner, Mr Dowens and Mr French don't say 'oh, that's rubbish.' They'd say, positive things about it and then they'd say something about it that we should work on and that helps so that we know what we can work on next time." (Phoebe)

Feedback from the students on their own perceptions of how well they could perform physically in their BMT lessons revealed that if the respondents perceived the task to be too challenging this lowered their levels of enjoyment, whereas, if the perception was that they were good at a specific physical task then this increased their levels of enjoyment.

"I liked the gymnastics sequences because, if they didn't tell you what you could do you just could go and do what you were good at, cause if they tell you to do something you might not be good at that so you could show everyone what you were good at and stuff like that and do it well cause you were gonna choose what, like, you're best at doing."(Gemima)

Students Theme 2 – Perception of what was learned

Three recurring themes were extracted from analysis of the student's perceptions of what was learned during their BMT lessons: technical skills, health and fitness and self-confidence. Students fed back that they learned some technical skills in BMT.

".. better movers better thinkers taught me to do a forward roll because I couldn't do a forward roll and then they told me to do this sort of thing where, with my hands up, roll then jump and it made me work better and in every sequence I used a forward roll in." (Kjeld)

Health and fitness was commented on by the students, but rather than a direct focus they seemed to perceive it as an indirect outcome from the BMT lessons.

"Well, I learned that even though exercise can be hard at some points better movers and thinkers gym was always fun and you didn't really realise that you were exercising all those parts of your body and your muscle but eh, in this time you just thought about having fun and you still improved in your skills that you were doing gym." (Monica)

Students mentioned that BMT helped them realise that everyone has different things that they are good at and that it is important to embrace difference. This was clarified with their perception being that self-esteem and social-confidence were improved during BMT sessions.

"You kinda learned that, just because you can't do something doesn't meant that you're a bad person or that you're, you're rubbish at everything but, better movers and thinkers say that, they say that it's okay not to be good at a handstand but you might be good at something else so say someone could do a handstand and you couldn't and you were, you feel that you're rubbish inside and all that, but better movers and thinkers would say well

maybe you're not good at that but you can do something else that they can't do and it makes you feel better about yourself." (Monica)

Students Theme 3 – Transfer Learning from PE to the Classroom

Students made a link between their bodies and brains both being challenged during BMT stating that*'[BMT] gets the brain going.'* Student comments were grouped into five different emergent themes which were; BMT gave you more energy for the day in the classroom compared to normal PE;

"Better movers and thinkers is good for class work because when you come to school usually, like see when I look at everybody in my group, including me, are all really tired and we all really need to get warmed up, well, like that's what better movers and thinkers does, it warms up your body and gets your brain ready for all the work that you're gonna do and it's just really helpful for class work."

BMT exercised your brain, normal PE did not;

"I learned that even though it's about exercising your body it's like exercising your brain as well cause it's like testing it"

After BMT, students felt they worked more efficiently and accurately;

"After I got back from better movers better thinkers I kinda thought like I was so tired, I was like, I was so tired like, I just got changed and I sat down to do my work and I was so tired that I just wanted to kinda get through my work and I knew all the answers and everything and got through my work a lot faster."

Students felt more successful in BMT sessions, which gave more confidence to learn in the classroom;

"I think it was just because after the experience I'd learned a bit and, I got, I'm not sure, I just, I thought I'd learned a bit. It made me a bit more confident in my work."

Improved concentration and more focus for the next lesson.

"I think it was before better movers and thinkers on a Tuesday we would get, music I think it is, right after gym and Miss Greer would come in and get us and I used to maybe, be like tired or something and I wouldn't do it properly but now in music on a Tuesday, like, before when, before better movers and thinkers finished, it was really, well, I could concentrate on what I was doing in music and I could, eh we got asked to make or eh compose some eh, eh music on the, eh,…Xylophone and I, I got through it and it was really good."

Class Teachers Theme 1 – Classroom behaviour (PE)

The class teacher reported that despite it being difficult for the children to concentrate for the entire lesson, she noticed that the students were entirely focussed from the beginning to the end of each session, and put this down to the nature of the BMT approach, and felt that the concentration from the students improved. She makes specific mention of the girls by stating *'I think the girls who are maybe a wee bit body conscious at this age…they were totally engaged and involved.'* She outlined that the students would often be working in pairs which helped to develop the students' confidence and that they were willing to try new things. She was particularly interested to note that '*the children chose*

their own partners in the gym and it was, it changed, it wasn't always the same partner so that was very interesting.'

Class Teacher Theme 2 – Links between BMT and the Class

The class teacher made direct links between BMT and Curriculum for Excellence (CfE) recognising the contribution that the sessions made to successful learners, effective contributors, and confident individuals (Scottish Executive, 2004a). A further link was made between language development in the classroom and the physical sentence structure that was being developed in BMT, with specific mention of the *'links and linking words and all that kinda of link, the, the language used and the children tuned in well to that too.'* She then went on to say that the focus and concentration that was developed in BMT raises the students' enthusiasm for learning and that this continues into the classroom and beyond. She specifically recalls seeing the students in the playground doing some of the actions that were part of BMT. Finally, the class teacher made a direct link between the sharing of ideas, appreciation of one another's work, working in pairs and good demonstrations of good practice as being something that the children do in BMT and in the classroom stating *'that is something we do in class a lot.'*

Class Teacher Theme 3 – School attendance

The class teacher found no connection between school attendances being different on BMT days compared to non-BMT days.

"I don't think they've actually made their attendance better on a PE day as far as I know."

4.4 Discussion

4.4.1 Main Findings

This study aimed to provide information about the efficacy, acceptability and feasibility of BMT as an approach to delivering PE in primary schools. Two schools received two PE lessons per week over 16 week duration between January and May with both conditions receiving the 32 planned sessions. The control condition received their PE provision from a combination of PE specialist, qualified NGB sports coaches and the class teacher. The intervention condition received all of their BMT sessions from the two experts who had contributed to the design and conception of BMT. The study was completed within the timescale allocated.

The findings from this study revealed statistically significant improved overall score changes in measures of working memory, phonological awareness and segmentation abilities for participants recruited to the BMT intervention condition. Significant group by gender interactions further revealed that boys in the intervention condition made greater gains than boys from the control condition in Phonological Composite Scores, Segments and Spelling subtests.

Traditionally the literature has revealed girls showing advanced language-based skills when compared to boys (Duckworth, A., & Seligman, M. E., 2006), yet findings from this exploratory study have shown boys to make more significant gains in scores on certain aspects of language-based tasks when compared to girls as a result of BMT. Therefore, these results are potentially important findings and provide evidence in support of BMT having a positive impact on learning.

The improvements identified in working memory hold specific significance to learning and educational processes as memory is considered the most basic and fundamental

concepts required for learning (Brown, J.K., & Minns, R.A., 1999). The statistically significant gains achieved in phonological awareness and segmentation scores are of similar interest to that of the working memory results as these are considered as the foundations of literacy development (Justice, L.M., & Pullem, P. C., 2003). These foundations are known to develop as part of emergent reading and spelling capabilities and the literature has shown that this typically happens in girls ahead of boys (Bruininks, R.H., 1978; Ehri, L.C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z. & Shanahan, T., 2001; Flynn, J.M. & Rahbar, M.H., 1994; Green, L. & Francis, J., 1988; Green, L.E.N. & Francis, J., 1988; Machin, S., & Pekkarinen, T., 2008). However, the results from this study identified boys making more significant gains and present a different finding from these previous studies. This may be due to the specific focus that BMT has on the development of EF skills; and in particular the enhancement of working memory, inhibitory control and cognitive flexibility. It could be suggested that improvements in EF skills may lead to concomitant improvements in attention and concentration levels as a result of improvements in self-regulatory behaviours. The literature has indicated a direct correlation between increased levels of attention and the development of phonological abilities (Ehri, L.C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z. & Shanahan, T., 2001; Green, L. & Francis, J., 1988; Green, L.E.N. & Francis, J., 1988). Qualitative findings support this theory as the class teacher made specific reference to the students having to concentrate throughout the duration of the BMT sessions inferring that this is not the case during traditional PE sessions. To substantiate this stance the class teacher remarked how the students remained engaged throughout the BMT session due to the *'nature of the programme*.'

It has been noted that the influence that improved levels of concentration can have on phonological awareness, and that phonological awareness positively influences spelling

(Muter, V., Hulme, C., Snowling, M. J. & Stevenson, J., 2004). It may be suggested that the findings from this study indicate that BMT has supported the development of attention and concentration with concomitant influence on academic achievement and in particular a relationship between gains in phonological awareness and improvements in spelling amongst boys. As boys traditionally lag behind girls in this area of development (Duckworth, A., & Seligman, M. E., 2006), these findings are interesting and provide evidence in support of BMT having a positive impact on learning.

However, results from the reading tests identified no main effect for the intervention condition suggesting that there has not been a transfer of skills from improved phonological abilities to reading competency as previous research has suggested (Bruininks, R.H., 1978; Machin, S., & Pekkarinen, T., 2008). It may be the duration of the intervention phase was not sufficient enough to allow for transference, or possibly that emergent reading skills develop before the age of this study cohort.

The significant findings from the LASS assessment may have been a result of the levels of Moderate-Vigorous Physical Activity (MVPA) achieved by the intervention condition being greater than that of the control condition, and may perhaps help explain for the gender interaction identified in some of the subtests. As no measurement for MVPA was used during the intervention phase sessions it is not possible to account for the effect of this potential variable. Similarly, no data were collected on the students' participation in PA outside of school, yet many studies have identified this as a key factor when evaluating the impact that PA has on academic achievement (Coe, D.P., *et al.*, 2006; Davis, C.L. & Cooper, S., 2011; Etnier, J.L., *et al.*, 2006). It could be suggested that limited engagement in MVPA may hinder the development of good coordination and balance control which may limit the direct engagement in PA and result in more sedentary behaviours. If there is a link between PA and academic achievement, then future studies

should take cognisance of this to help account for the differences identified within this pilot study.

The results from the MABC2 identified that balance and postural control scores did not change over the course of this study, as a ceiling effect was observed. These subtests were used as static balance reaches adult levels for open-eye conditions[3] between 9 and 10 years of age but in retrospect they may not have been sensitive enough for this particular cohort (Wolff, D.R., Rose, J., Jones, V. K., Block, D. A., Oehlert, J. W., & Gamble, J. G., 1998). It has been suggested that static balance maintenance supports the fundamental process of coordinated accurate movements and therefore it could be suggested that any flaws in static balance may limit the student's access to a worthwhile and positive PE experience as it has the potential to detrimentally affect coordination (Nashner, L.M., Shumway-Cook, A., & Marin, O., 1983). Student feedback clearly identified that their enjoyment levels were often linked to their perceived physical competence and therefore poor self-image may result in a disengagement from PE (and PA) altogether. Within this study perhaps students with under-developed static balance capabilities were not identified as a symptom of the limitations within the measurement tool used. However, the MABC2 is a popular instrument for the evaluation and identification of children with motor impairment and is used in many clinical and research contexts where studies on validity have shown 80% agreement between the MABC2 and 'Bruininks-Oseretsky Test of Motor Performance' (Bruininks, R.H., 1978; Chow, S.M.K., & Henderson, S. E., 2003; Croce, R.V., Horvat, M. & McCarthy, E., 2001).

Variables that have not been investigated within this study, such as intensity of the PA and/or the individual student differences (i.e. motivation) may help explain for the

[3] Other tests of static balance are performed with the eyes closed, but all of the subtest within the MABC2 are performed with the eyes open.

different results. Similarly, no evaluation of the level of teaching expertise or experience was taken into account but may also have impacted upon results.

Findings from the pilot study provide an opportunity for a larger-scaled study to be conducted. Some key adjustments and additions need to be made to the measurement tools used in order to design a more robust study.

4.4.2 Strengths

The schools used within the current study shared catchment areas, had a similar school roll and similar PE resources. This helped to reduce the possible influence of other known variables such as socio-economic status (Rhoades, B.L.*, et al.*, 2011) and class sizes (Wilson, V., 2007) from influencing the results.

Both the control and intervention condition received 16 weeks of PE with no omissions. This prevented time spent doing PE being a confounding variable as both conditions received 32 sessions during the 16-week intervention phase.

Testing was completed by the main researcher at both pre- and post-test in the same location within the school for all students. This standardised operational procedures and allowed the students to feel secure within the process. The validity and reliability of both assessment tools used were good for this exploratory study, and both were standardised for a UK population allowing for it to be free from any cultural interpretations as the study took place within Scotland.

Pre-testing was completed in both conditions in December 2011 before the start of the intervention phase in January 2012, and post-testing was completed in both schools within two weeks from the end date of the intervention phase (May 2012). This reduced the influence that time of testing could have had on the data gained in either condition.

The estimate of internal consistency associated with the composite scores for working memory was moderate (α = .61) suggesting good reliability and validity in using a composite score for the two memory subtests.

The teachers and NGB sports coaches delivering the PE experience in either condition were not involved in the collection of the quantitative or qualitative data, or in the analysis of the results. Similarly, the independent researcher who conducted the student focus group and class teacher interview was not involved in the analysis of the quantitative or qualitative data helping to reduce the level of bias as they were blind to the procedures of the intervention and other assessment tools.

4.4.3 Limitations

No measurement of the student's overall level of PA was taken at pre- or post-intervention. There is a considerable amount of research that identifies school-aged students who have increased levels of time spent being physically active typically perform better in academic tasks than those who are less physically active (Coe, D.P., *et al.*, 2006; Davis, C.L. & Cooper, S., 2011; Etnier, J.L., *et al.*, 2006; Trudeau, F. & Shephard, R.J., 2010).

There was no measure of the intensity levels of PA being achieved by the students during their PE lessons. Studies have shown a different impact on academic performance depending on acute bouts of exercise or chronic bouts of exercise (Ahn, S. & Fedewa, A.L., 2011; Biddle, S.J.H. & Asare, M., 2011).

The expertise and experience levels of the teachers as well as their adopted style when delivering PE was not evaluated or compared. Studies have shown that the approach adopted by the teacher can have a significant effect on the outcomes achieved during the lessons and therefore can have an impact on any benefits associated with this learning

opportunity for students (Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R., 2009; Chatoupis, C., 2009; Demetriou, Y. & Höner, O., 2012) . In addition to this, the teachers delivering to the intervention condition contributed to the development of BMT and therefore may have been more motivated to achieve significant results than those who conducted the control condition lessons.

The control condition received their PE provision on Mondays and Thursdays and the intervention condition received their provision on Tuesdays and Thursdays. It may be suggested that the delivery to students on different days of the week may have been a confounding variable as their attitudes and motivations to participate in the PE lessons may have been different given that one school received their first session of the week on Mondays (immediately after the weekend) and the other on Tuesdays. This could therefore have had the potential to influence the results realised from the outcome measures.

The measurement tool used for evaluating the physical competence of the students was limited and this restricted the possibility of identifying students with movement difficulties. Therefore, motor incompetence could not be taken into account during the results analysis.

The estimate of internal consistency associated with the composite scores for reading was low ($\alpha = .28$) and similarly the composite score for phonological subtests was low ($\alpha = .44$) when conducting and interpreting internal consistency reliability analysis through Cronbach alphas (Sijtsma, K., 2009).

The reading tests used within LASS 8 – 11 did not best reflect a pure sight word reading test or cloze reading test as pictures are provided as part of these tests. The illustration represents a non-verbal process and may assist the students in identifying the correct word

from 5 possible answers. This does not involve the student having to sound out the components of the word itself in order to read it correctly. The word is read out to the child which does result in the child's need to process the information phonologically, but in the presence of the non-verbal information being provided (i.e. the visual representation of the picture), it reduces the level of reading and phonological processing that has to be done in order to complete this task.

4.5 Conclusion

Quantitative results showed there was an effect between school with the intervention making statistically significant gains in working memory, phonological awareness and segmentation abilities. The quantitative data analysis showed results in spelling that were approaching significance, though the small sample size did not allow for this. There was a group by gender interaction identified and in particular; male students in the intervention condition made significant gains in comparison to the male students in the control condition in measures of phonological awareness, segmentation abilities and spelling. Gains being made, especially for boys, indicate a potential mapping between BMT and academic skills. The gains may be attributed to specific improvements in EF skills, and in particular to inhibitory control, cognitive flexibility and working memory, though further research is required where a direct measure of these core EF skills could be included. This study only included measures of working memory.

Qualitative results indicated that students enjoyed BMT as a different approach to PE and the class teacher felt that it enhanced aspects of classroom learning and in particular the engagement of the girls in PE. The findings support BMT as one approach to PE with concomitant benefits to academic achievement and EF skills.

CHAPTER 5: STUDY TWO - BETTER MOVERS AND THINKERS (BMT): A QUASI-EXPERIMENTAL STUDY INTO THE IMPACT OF PHYSICAL EDUCATION ON CHILDREN'S COGNITION – A STUDY PROTOCOL

One article has been published from the findings of this study (Dalziell, A., Boyle, J., & Mutrie, N., 2015a):

Dalziell, A. G., Mutrie, N.M., & Boyle, J. (2015) Better Movers and Thinkers (BMT): A Quasi-Experimental Study into the Impact of Physical Education on Children's Cognition - A Study Protocol. Preventive Medicine Reports (in press)

5.1 Introduction

Low levels of physical activity (PA) are common in children and there has been a clear call for action on the "pandemic of physical inactivity" (Kohl, r.H.W., *et al.*, 2012). Engagement in PA is well known to be beneficial for physical health and mental health benefits (Biddle, S.J.H. & Asare, M., 2011; Eide, E.R., *et al.*, 2010; Etnier, J.L., *et al.*, 2006; Tomporowski, P.D., *et al.*, 2011). Increased levels of PA have been linked to improvements in physical health and mental health including cognition (Biddle, S.J.H. & Asare, M., 2011; Coe, D.P., *et al.*, 2006; Hillman, C.H., Castelli, D.M., & Buck, S.M., 2005; Marjanovic Umek, L., Kranjc, S., Fekonja, U., & Bajc, K., 2008; Marjanovič Umek, L., *et al.*, 2008; Tomporowski, P.D., *et al.*, 2008). Higher levels of fitness in children may be associated with improved neurocognitive processing (Hillman, C.H., *et al.*, 2008) as well as increased levels of PA positively influencing learning by enhancing school 'on-task' behaviours (Davis, C.L. & Cooper, S., 2011). Increased time spent participating in physical education (PE) within the curriculum may provide both cognitive and educational benefits across childhood and adolescence (Coe, D.P., *et al.*, 2006) . The literature is consistent in reporting that increasing the amount of time in PE within school

does not adversely affect more academic subjects. Indeed there are examples of higher levels of time spent in PE enhancing academic attainment (Coe, D.P*., et al.*, 2006; Davis, C.L. & Cooper, S., 2011; Donnelly, J.E*., et al.*, 2009; Eide, E.R*., et al.*, 2010; Mahar, M.T., Murphy, S.K., Rowe, D.A. *et al.*, 2006).

Within the literature two closely related constructs of attention and cognition have been linked to children's mental health and aspects of children's learning (Christopher, M.E., Miyake, A., Keenan, J.M. *et al.*, 2012; Eide, E.R*., et al.*, 2010; Etnier, J.L*., et al.*, 2006; Kohl, r.H.W*., et al.*, 2012; St Clair-Thompson, H.L. & Gathercole, S.E., 2006). What is not clear from the literature is the scope in which children's level of cognition can be changed through traditional training programmes with a recent review describing it as "extremely difficult"(Wass, S.V., Scerif, G., & Johnson, M.H., 2012). Another review concluded that there was insufficient evidence to suggest that increasing time in PE leads to improvements in cognition and academic achievement. The authors did add that the evidence was also insufficient to suggest that increasing the time in PE detrimentally influenced academic achievement (Keeley, T.J.H. & Fox, K.R., 2009; Tomporowski, P.D*., et al.*, 2008).

In contrast a recent review has suggested that areas of cognition, including working memory, selective attention and inhibition tasks, are the areas of greatest benefit for children who increase their levels of PA (Coe, D.P*., et al.*, 2006; Guiney, H. & Machado, L., 2013). Similarly another review examined the effect of PA on children's cognition and found that both acute and chronic exercise may produce improvements in cognition (Best, J.R*., et al.*, 2011). A review of studies on PA examining mental health outcomes also found a positive association with cognition in randomised studies (Ahn, S. & Fedewa, A.L., 2011). These positive associations were also identified in another review

though there is an acknowledgement that the improvements in cognition and academic achievement are usually small or inconsistent (Biddle, S.J.H. & Asare, M., 2011).

There is a need for studies to focus on the potential longer-term impact of PE in school on children's cognition and to specifically evaluate the nature and quality of PE provision to identify how different approaches may have differing effects on cognition (e.g. training of cognitive aspects in PE, dose-related response). There is a need for a study to be conducted within a Scottish context.

This chapter provides the methodological protocol that will allow a robust evaluation of effects of BMT on children's cognition, gross motor coordination (GMC) and PA habits in comparison to a traditional approach in PE within the primary school setting in Scotland. In addition to cognitive measures, the current study will evaluate GMC and PA habits in order to account for these potential variables as identified in other studies (Booth, J.N.*, et al.*, 2014; Green, L. & Francis, J., 1988; Green, L.F., J., 1988). If an alternative approach to the delivery of PE in schools can lead to improvements in children's cognition this would have implications for improvements in academic achievement and help to inform interventions for those children who are not engaging in PE regularly in school and PA in other areas of their lives.

5.2 Aim

The aim of this study is to evaluate if there is a link between BMT and cognition and GMC, to identify if there is a correlation between levels of PA and cognition and to gain an understanding into the perceptions of students and teachers of BMT as an alternative approach to PE. The main research questions are:

1. Does BMT improve cognition, GMC and PA habits more than traditional PE provision?

2. Is there a relationship between cognitive development, GMC and PA habits?
3. What are the students' perceptions and experiences of PE/BMT provision?
4. What are class teachers' views of how PE/BMT provision influences the learning and behaviours of students across the curriculum?

5.3 Methods

5.3.1 Ethics Approval

All procedures were approved by the local authority and the relevant University Ethics Committees and written and informed consent was obtained from all participants.

5.3.2 Statistical Analyses

ANCOVA will be used to adjust for any pre-test differences to compare the post-intervention performance of the control condition with that of the intervention condition. The relationship between levels of cognition, coordination and PA will be modelled using a multiple regression with bootstrapping if required (Miles, J. & Shevlin, M., 2001). The focus groups and class teacher interviews will be recorded and transcribed before identifying emergent themes within the data using a grounded theory approach (Corbin, J.M. & Strauss, A.L., 2008).

5.3.3 Study Design

The study will involve six mainstream state schools, Primary 6 students (aged 9 – 11 years) in three schools acting as the control condition and Primary 6 (P6) students in the other three schools acting as the intervention condition. The allocation of schools to condition will be undertaken by the Quality Improvement Officer (QIO) within the local authority. There are a number of potential schools and the QIO will choose schools based on two criteria; their proximity with one another ensuring that they are close to each other;

and; schools where he thinks that it would be feasible to run the research. Once the schools have been identified, they will be placed within opaque-sealed envelopes and a person external to the study will choose 3 schools which will be allocated as the intervention condition leaving the other 3 as the control condition. The design of the study is a 16-week intervention with pre-, post- and 6 month follow-up measurements taken from the Cognitive Assessment System (CAS) (Naglieri, J.A. & Das, J., 1997), GMC tests and the Physical Activity Questionnaire for Older Children (PAQ-C) (Kowalski, K.C., Crocker, P.R., & Donen, R.M., 2004) gathering quantitative data. These are explained in more detail later. At the end of the 16-week intervention phase 6 focus groups will be conducted separately for students (approx. 8 students in each) in all schools. One-to-one interviews, lasting approximately 10 – 20 minutes will be conducted with each of the class teachers. The focus groups and interviews will be analysed qualitatively.

5.3.4 Recruitment Procedures

The Local Authority (LA) will be approached to grant access to involve six primary schools. Six primary schools will be identified by of the 'Quality Improvement Officer (QIO)' and if necessary substitute schools will be identified.

Having identified the six schools, letters will be sent to each of the head teachers outlining the research and seeking permission for their involvement. This will be followed-up, one week later, with a phone call and a meeting will be arranged between the main researcher, and the head teacher to explain the research in more detail. If each of the head teachers agrees to their involvement, each student will be provided with an information sheet to take home to their parents with a consent form for their parents to sign indicating that they are happy for their child(ren) to be involved in the study. The main researcher will

attend a separate meeting with each P6 class outlining the nature of the research study. Students will be provided with an information sheet as the main researcher explains what the student involvement would be. Questions that arise will be answered before students are provided with assent forms to complete and sign if they wish to be involved in the study.

5.3.5 Study Sample

The schools identified by the QIO, may yield approximately 150 - 180 students who could provide assent to be involved throughout the study. Throughout the study all parents and students will have the right to withdraw from the study.

5.3.6 Primary Outcome Measures

Cognitive Assessment System

The CAS (Naglieri, J.A. & Das, J., 1997) was developed to evaluate Planning, Attention, Simultaneous and Successive (PASS) cognitive processes of individuals aged between 5 and 17 years. The PASS theory provides a view of intelligence reconceptualised as cognitive processes and proposes that human cognitive function is based on these four essential activities that employ and alter an individual's base of knowledge (Das, J.P., Naglieri, J. A., & Kirby J. R., 1994). According to this theory, human cognitive functioning includes four components: planning processes that provide cognitive control; utilisation of processes and knowledge, intentionality, and self-regulation to achieve a desired goal; attentional processes that provide focused, selective cognitive activity over time; and simultaneous and successive information processes that are the two forms of operating on information. Planning is a mental process by which the individual determines, selects, applies and evaluates solutions to problems. Attention is a mental process by which the individual selectively focuses on particular stimuli while inhibiting

responses to competing stimuli presented over time. Simultaneous processing is a mental process by which the individual integrates separate stimuli into a single whole or group. Successive processing is a mental process by which the individual integrates stimuli into a specific serial order that forms a chain-like progression. The CAS has two formats that could be used as measurement tools for children's cognition; the Standard Battery (involving 12 subtests, 3 for each category in PASS) and the Basic Battery (involving 8 subtests, 2 for each category of PASS). Due to the logistical limitations of conducting research within the school environment this study will use the Basic Battery. The Planning subtests are 'Matching Numbers (MN)' and 'Planned Codes (PCd).' Attention subtests include 'Expressive Attention (EA)' and 'Number Detection (ND).' 'Non-verbal Matrices (NvM)' and 'Verbal-Spatial Relations (VSR)' make up the Simultaneous subtests whilst 'Word Series (WS)' and 'Sentence Repetition (SR)' make up the Successive subtests. Each subtest scaled score is set at a mean of 10 and a standard deviation of 3. The CAS is intended to predict academic achievement in children and the full scale standard score will typically be the best overall predictor of achievement.

Reliability and Validity

Subtest reliability coefficients were calculated by the split-half method for all Simultaneous and Successive subtests using the entire standardisation sample and obtained from the administrator's manual. The average reliabilities for the Basic Battery are .85 (Planning), .84 (Attention), .90 (Simultaneous) and .90 (Successive). A study into the reliability of the CAS identified reliabilities in all PASS subscales in all age groups ranged from 0.83 – 0.93 (Naglieri, J.A. & Das, J., 1997) indicating a high level of reliability and validity in using CAS as the cognitive measurement tool within this study. Subtest reliabilities are similarly high ranging from .75 to .89 across subtests with a median reliability of .82.

Gross Motor Coordination (GMC)

Students will be asked to perform 4 GMC tasks. These 4 tasks will involve the fundamental locomotor skills of; crawling on the stomach (i.e. commando crawl), creeping on hands and knees (i.e. 4-point crawling), marching with an arm swing (i.e. like a soldier) and skipping with an arm swing (i.e. without a rope). Each student will have a 5 metre distance to travel between and will be asked to perform each task twice. The assessments will be video recorded and movement patterns will be coded for the purposes of data collection using a 5-point scoring system. The scoring system will be as follows:

1 = Unable to perform the task

2 = Disintegrated (no consistency in the coordination of both halves and sides of the body)

3 = Homologous (upper and lower body not integrated)

4 = Homolateral (same sided limbs move in the same direction simultaneously)

5 = Contralateral (opposite sided limbs move in the same direction simultaneously)

Individual scores from the 4 tasks will be accumulated to create an overall score which will be used for the purpose of analysis.

Physical Activity Habits Questionnaire for Older Children (PAQ-C) (Kowalski, K.C., *et al.*, 2004)

The PAQ-C provides a general measure of PA from ages 8 – 20 years. The PAQ-C is appropriate for school-aged children (approximately 8 – 14 years) who are currently in the school system and have a rest interval as a regular part of their school week. The PAQ-C are self-administered, 7-day recall questionnaires that measure general moderate to vigorous PA levels during the school year. Generally the PAQ-C has had relatively strong correlation coefficients with other PA measures compared to other recall measures

(Crocker, P., Bailey, D.A., Faulkner, R.A., Kowalski, K.C., & McGrath, R., 1997).

5.3.7 Procedures

The PAQ-C will be conducted with the whole class, and the main researcher will read through each question and be available to answer any queries from the students. Physical testing using the GMC tasks will be carried out with each student, in groups of 4 or 5 before completing the CAS with each student on a separate day. CAS testing will be conducted on a one-to-one basis with the main researcher and will take place within a quiet space within the school. Each student will be thanked by the main researcher on completion of the testing and will be told that they will be tested again at the end of the intervention phase and at 6-month follow up.

Fidelity measures will be used to ensure the reliability of data being collected using the CAS, PAQ-C and GMC tests. This will be carried out by an independent researcher at pre-, post- and follow-up testing. Video footage of the BMT approach will be recorded and analysed for fidelity of the approach.

Intervention Phase

All schools will be asked to provide two 60-minute sessions of PE each week, for 16 weeks.

Control Condition

The control condition will receive their PE provision from a combination of both the PE specialist and the class teacher, and will traditionally cover a range of activities. The control condition will be receiving the PE curriculum as outlined by Curriculum for Excellence (CfE) in Scotland (Scottish Executive, 2004a).

Traditional PE does not specifically involve the development of cognitive skills as a specific outcome but is primarily concerned with the development of technical and tactical skills within specific sports, activities and games.

Intervention

Participants in the intervention condition will receive their provision from a PE specialist who has received training in the delivery of BMT and will cover a range of activities. The PE specialists will take two sessions per week in each of the intervention schools. No other PE sessions will be provided during the intervention. The BMT practices in PE primarily focus on the development of cognition (and specifically Executive Function skills[i]) and the quality of motor control with the aim that this has transfer to other aspects of learning across the curriculum.

5.3.8 Qualitative Study

Students will be offered the opportunity to participate in focus groups (3 for both the control and intervention conditions, each having approximately 8 students taking part at any one time) at the end of the study. 4 boys and 4 girls from each P6 class will be randomly selected by their head teacher drawing out names from a hat. Three main areas will be discussed in the focus groups including; enjoyment levels, perceptions of what has been learned in the PE lessons and, perceived transfer of learning in PE lessons into other lessons (i.e. literacy, numeracy, art, music, drama etc.). Each of the main areas will have some starting questions to encourage student response. These include:

The experiences of the students during their PE lessons

1. Tell me about the activities you participated in during your PE lessons from January to May this year?
2. What did you think about these experiences?

3. How did these experiences make you feel?
4. What experiences would you like in future PE lessons?

Perception of what has been learned in PE lessons

1. What did you learn in your PE lessons from January to May this year?
2. Give an example of what you were doing and how you learned this
3. How did you feel when you were learning this?

Perceived transfer of learning from PE lessons to other subject lessons

1. How is learning in PE different to learning in other lessons?
2. What similarities exist between learning in PE and learning in other lessons?

Each of the 6 class teachers will be taken through an interview. The main areas to be covered include; impact of the teaching of PE to students' engagement with PE, student behaviour in the class, perceived impact of PE on students' learning across the curriculum.

Perceived impact of the teaching of PE to students' engagement with PE

1. How does the approach in delivering PE impact on the students' engagement in PE lessons?
2. What observations in students' learning behaviour have you seen during PE lessons between January and May this year?

Student behaviour in class

1. What observations in students' learning behaviour have you seen during classroom lessons between January and May this year?

2. How do the learning behaviours of the students in the classroom compare to their learning behaviour in PE lessons?

Perceived impact of PE on students' learning across the curriculum

1. What effect do you think PE has on your students' ability to learn across the curriculum?

The focus groups and classroom teacher interviews will be carried out by an independent research assistant who is not involved in the quantitative testing protocols or in the delivery of any of the PE lessons within the study. The research assistant will have specialist skills in the facilitation of focus groups and semi-structured interviews.

Setting

The PE lessons will be conducted within the gym facilities and outside areas at the schools. Quantitative data will be gathered within a quiet space within the school with the main researcher and the qualitative data will be gathered within a meeting room within the school in the presence of the research team assistant conducting the focus groups and class teacher interviews.

Data Management

Quantitative data will be entered into an SPSS Data file and stored in a secure network drive. Qualitative data will be audio-recorded, transcribed verbatim and anonymised. Digital copies of the transcribed data from the student focus groups and the class teacher interview transcripts will be kept in a secure cabinet.

5.3.9 Data Analysis

Quantitative Data

CAS

Each of the CAS subtest raw scores is converted to a scaled score based upon the child's age using a conversion table. Each of the four PASS scales is obtained by summing the subtest scaled scores from each of the subtests within the respective scales. The CAS full scale is obtained from the sum of the standard scores for the 8 PASS Scale subtests. For the purposes of data analysis within this study, the overall scaled scores for the CAS basic battery will be used for comparison.

GMC

The GMC tasks will be measured using the following 5-point scoring system;

1 = Unable to perform the task

2 = Disintegrated (no consistency in the coordination of both halves and sides of the body)

3 = Homologous (upper and lower body not integrated)

4 = Homolateral (same sided limbs move in the same direction simultaneously)

5 = Contralateral (opposite sided limbs move in the same direction simultaneously)

An accumulative score for all 5 subtests will be used for the purposes of comparing results between all 3 time points; baseline, post-test (at the end of the 16 week intervention), and follow-up (6 months). All quantitative data will be cross-checked with 3 independent researchers each of whom specialises in the use of CAS, PAQ-C and fundamental locomotor skills.

Qualitative Data

Focus groups and class teacher interviews will be conducted by an independent researcher who has an expertise in this particular area of qualitative data collection. The focus groups and class teacher interviews will be recorded using audio-recording equipment and the main researcher will then provide a verbatim transcription that will then be analysed thematically.

5.4 Discussion

This protocol provides the details of the rationale and design of the study and details of the intervention, outcome measures and the recruitment process. Effect sizes derived from comparison between the intervention and control conditions from the study will provide information on the effectiveness of delivering BMT as an alternative PE provision within primary schools; evaluate the relationship between levels of PA, GMC and cognition. A 6-month follow-up at the end of the intervention phase will conclude this study.

The study will address: a) the need for a Scottish based study into the links between PA, GMC and cognition; b) how the nature of the activities provided during traditional PE and BMT impact differently on the development of cognition; c) documentation and analyses of the experiences and perceptions of PE/BMT lessons from participants within this study and d) if effects are maintained 6 months after the intervention.

5.4.1 Strengths

The study could identify an alternative teaching method that helps to provide quality PE provision for all primary school-aged students. The perceptions of the participants may

provide interesting insights that help identify effective strategies that further encourage the government's health agenda and helps get more children within Scotland active on a daily basis. Children from control and intervention conditions will come from a range of socio-economic backgrounds and will include students with and without additional support needs. This is the first study to systematically explore the potential benefits of the BMT approach with such an inclusive cohort. The primary outcome measures used in this study are standardised test scores which have a high rated inter-rater and test-retest reliability. Fidelity testing will be undertaken by 3 researchers who are independent of the study in order to compare inter-rate reliability to ensure that appropriate procedures are being adhered to. The main researcher is involved in the gathering of the quantitative data but not the qualitative data and will not be involved in the delivery or evaluation of any of the PE/BMT sessions.

5.4.2 Limitations

Variables identified in the literature that may impact upon differences in outcome measures include; age, birth weight, gestation, age of mother at delivery, mother's oily fish intake at 32 weeks gestation, maternal smoking in the first 3 months of pregnancy, weight status, pubescent stage, ethnicity, socio-economic status (SES) and occupational social class (Booth, J.N.*, et al.*, 2013). It has not been possible to control for all of these variables within this study. For example, students from both conditions will not be measured using Body Mass Index (BMI) though previous studies highlight the impact that this can have on the outcomes being measured (Aktop, A., 2010; Davis, C.L. & Cooper, S., 2011; Eide, E.R.*, et al.*, 2010). Similarly, no information was gathered about the pre-school provision of the students prior to the start of this study and again there are previous studies that have illustrated the impact that pre-school provision can have on cognition (Diamond, A.*, et al.*, 2007; Marjanovic Umek, L.*, et al.*, 2008).

An additional limitation is the gathering of PA habits through self-reported questionnaires. Self-reported levels of PA may over report actual levels of PA, especially as the data collection will be performed as a whole class. Objective measures of PA would perhaps further enhance this study, but pragmatically is beyond the capacity of this study (Coe, D.P., *et al.*, 2006).

The short length of intervention phase (16 weeks) may also limit this study. Sufficient time between the pre- and post-test phases may not allow for any change to be identified within the three variables being measured. As this study accounts for only P6 students within one authority, it may be difficult to generalise any findings to a wider population.

CHAPTER 6: STUDY 2 - BETTER MOVERS AND THINKERS (BMT): A QUASI-EXPERIMENTAL STUDY INTO THE IMPACT OF PHYSICAL EDUCATION, PHYSICAL ACTIVITY AND COORDINATION ON CHILDREN'S COGNITION.

6.1 Introduction

Emerging research indicates a link between increasing levels of physical activity (PA) and improved levels of cognitive function and brain health in childhood (Khan, N.A. & Hillman, C.H., 2014). Studies indicate that children with higher-levels of fitness achieve better scores on standardised achievement tests than their less-fit counterparts (Castelli, D.M., Hillman, C.H., Buck, S.M., & Erwin, H.E., 2007; Donnelly, J.E.*, et al.*, 2009). However, low-levels of PA are common in children and a recent evaluation indicated that there is much work to be done in order to improve the health and wellbeing of children if improvement in their cognitive function and brain health are then to be realised (Booth, J.N.*, et al.*, 2013).

Increasing opportunities for daily PE lessons within school is one way which to address the *pandemic* of inactivity (Strong, W.B.*, et al.*, 2005) although there are concerns that this may detrimentally impact on academic progress in other curricular areas (Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R., 2009; Biddle, S.J.H. & Asare, M., 2011). However, there is no consistent evidence to suggest that progress in academic subjects is adversely affected as a consequence of increasing time spent in PE classes in schools (Coe, D.P.*, et al.*, 2006; Donnelly, J.E.*, et al.*, 2009; Hillman, C.H.*, et al.*, 2005). Indeed some studies report improvements in on-task behaviour in class as a result of increased PA. Such improved on-task behaviours are known to positively influence learning and have been shown to lead to academic progress (Donnelly, J.E.*, et al.*, 2009).

Increased access to PE (and PA in general) may therefore provide cognitive and educational benefits across childhood and through adolescence. However, caution is required as some children within the school may not be able to access this benefit due to their coordination limitations (Green, L. & Francis, J., 1988).

There is a need for more research in this area to establish the nature of the relationship between cognition and increasing PA (Biddle, S.J.H. & Asare, M., 2011; Fisher, A.*, et al.*, 2011). Reviews of PA and cognitive functioning have provided evidence in support of associated cognitive and academic performance gains along with increased PA although these associations are usually small and inconsistent (Biddle, S.J.H. & Asare, M., 2011; Etnier, J.L.*, et al.*, 2006). Some of these inconsistencies have been associated with a lack of understanding as to whether there is a direct or indirect effect from increasing levels of PA in children and gains in their cognitive performance. In a review conducted in 2011 it was concluded that children's cognitive functioning can be enhanced through PA but this is mainly in respect of executive functioning tasks (Tomporowski, P.D.*, et al.*, 2011). What remains unclear from the research is what types of activities (for example, aerobic or complex movement patterns) have the greatest effect and what levels of activity (for example, acute or chronic bouts) needs to be achieved for gains to be identified. This then needs to be clarified with a better understanding of how this relates to improved cognitive performance. In order to establish if the nature of the tasks is a contributing factor, this study evaluated the impact of a novel approach to PE compared to traditional PE where the nature and demands of the PE lessons were specifically different.

6.2 Aim

The present study aimed to explore the impact of BMT on children's coordination and cognition in comparison to existing provision in PE and in consideration of PA habits.

6.3 Methods

A pilot study was conducted prior to finalising the methodological approach (Dalziell, A.G.*, et al.*, 2015b). Results from the pilot study identified an effect between pre- and post-test conditions in phonological skills (p = .042), and working memory (p = .040) in favour of intervention following a 16-week intervention phase. The pilot study evaluated the feasibility of a 16-week intervention phase within primary schools. There were certain limitations identified within the pilot study that has informed the current study. For example, teaching expertise was identified as a possible contributing factor in gains made in favour of intervention. There were limitations with some of the outcome measures used within the pilot study and again this has informed the design of the main study. Further explanation can be found in the protocol paper (Dalziell, A.*, et al.*, 2015a).

6.3.1 Participants

Primary 6 students (n = 150) from 6 mainstream state schools in one local authority in Scotland were invited to take part in the study. The average age of students was 10.00 years (*SD* = 0.35). 70 students were in the intervention condition (30 girls and 40 boys) and 80 students in the control condition (38 girls and 42 boys). Parents gave informed written consent and students gave informed written assent. The study was approved by the University of Edinburgh Ethics Committee and permission granted by the Ethics Committee of the local authority within which the study took place. All children were eligible to be included in the study including those with additional support needs. Head

teachers of each of the 6 schools granted permission for their school to be used within the study and class teachers agreed to their class being involved.

6.3.2 Study Design

Using a quasi-experimental design, a 16-week intervention was set up in the 6 participating schools with students in the age range 9 – 11 years. Three schools were in a control condition and received existing PE provision and three schools were in an intervention condition and received the BMT approach to PE. The protocol paper for this study will provide more detail on the recruitment and allocation of schools, information on who delivered PE in both conditions and information regarding testing procedures and selection of the outcome measures used (Dalziell, A.G., Boyle, J., & , & Mutrie, N., 2015a). The study was presented in 4 phases (see Figure 6.1).

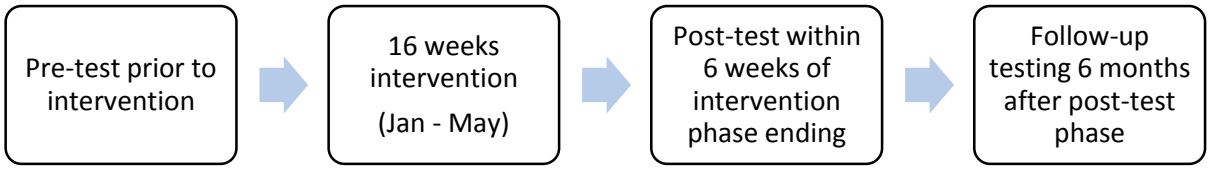


Figure 6.1: Chronology for pre-test (T1), intervention phase, post-test (T2) and Follow-up testing (T3)

Following initial recruitment, and upon receipt of parental consent and student assent a pre-test (T1) of CAS, PAQ-C and GMC was undertaken prior to the beginning of the 16-week intervention phase. Post-test (T2) was completed within 6 weeks of the conclusion of the intervention phase, and finally follow-up (T3) testing was completed within 6 months from post-test.

6.3.3 Primary Outcome Measures

Cognitive Assessment System (CAS) (Naglieri, J.A. & Das, J., 1997)

A literature search and contact with an educational psychologist prior to the present study indicated the suitability of the CAS as a measure of cognitive performance in school-aged children. There are 2 forms of the CAS, and the basic battery form (involving 8 subtests) was used due to the logistical demands of running research within a school environment as well as the demands on time of the study. All subtests were administered to students individually in a quiet location within the school, and presented in the order as outlined in the procedural handbook associated with the CAS (Naglieri, J.A. & Das, J., 1997). Verbal instructions presented for each subtest were prescribed within the handbook and used for each student at T1, T2 and T3 testing. The time taken to complete the CAS ranged from 40 – 52 minutes.

Physical Activity Habits Questionnaire for Children (PAQ-C) (Kowalski, K.C*., et al.*, 2004)

The PAQ-C is appropriate for school-aged children (approximately 8 – 14 years) who are currently in the school system and have a rest interval as a regular part of their school week. The PAQ-C is a 7-day recall instrument that measures general MVPA levels during the school year. Generally the PAQ-C has had relatively strong correlation coefficients with other PA measures compared to other recall measures (Crocker, P*., et al.*, 1997). The PAQ-C was conducted with the whole class, with the main researcher reading through each question before the students completed their answer. Previous studies have demonstrated the suitability and reliability of conducting the PAQ-C in this manner (Niven, A.G., Fawkner, S.G., Knowles, A.-M., & Stephenson, C., 2007).

Gross Motor Coordination

Students were asked to perform 4 GMC tasks. These 4 tasks involved the fundamental locomotor skills of; crawling on the stomach (i.e. commando crawl), creeping on hands and knees (i.e. 4-point crawling), marching with an arm swing (i.e. like a soldier) and skipping with an arm swing (i.e. without a rope). Each student had a 5 metre distance to travel between and was asked to perform each task twice. The assessments were video recorded and movement patterns were coded for the purposes of data collection using a 5-point scoring system. The scoring system was as follows:

1 = Unable to perform the task

2 = Disintegrated (no consistency in the coordination of both halves and sides of the body)

3 = Homologous (upper and lower body not integrated)

4 = Homolateral (same sided limbs move in the same direction simultaneously)

5 = Contralateral (opposite sided limbs move in the same direction simultaneously)

Individual scores from the 4 tasks were accumulated to create an overall score which was used for the purpose of analysis. Fundamental locomotor skills have been widely used for a number of years in clinical and educational research and are considered reliable methods when evaluating the development of gross motor coordination in school-aged children (Henderson, S.E., Sugden, D. A. & Barnett, A. L., 2007).

6.3.4 Data Analysis

Baseline data collection for all three outcome measures was completed prior to the start of the intervention phase and T2 testing was completed within 6 weeks of the intervention phase ending. T3 testing was completed at a 6-month interval from T2 testing. The time

between T1 and T2 testing and between T2 and T3 testing remained constant across all schools. Cross scoring of all 3 outcome measures was undertaken by independent researchers with expertise in the use of the outcome measures to verify the data. Statistical analysis was undertaken by ANCOVA using SPSS version 19 with baseline scores as covariate, schools as the independent variable and the outcome measures as dependent variables (Field, A., 2009).

6.4 Results

The data was not normally distributed for all 3 outcome measures and a log transformation was applied but did not address skewness or kurtosis. A linear-model was applied but did not appreciably improve the skewness or kurtosis and therefore bootstrapping was applied. Bootstrapping was used to define confidence intervals by taking 1000 samples from the data based on actual distribution. The statistical analysis did not account for any clustering.

6.4.1 CAS

A total of 143 children (78 students for control and 65 students for intervention) presented a full data-set at T2 testing using the cognitive outcome measure; representing 95% of those from the original data set of 150 students at T1 testing. Missing data was minimal and imputation was therefore not applied.

Table 6.1 shows the means and standard deviation (SD) for CAS from T1 to T2 and Bias Corrected Accelerated (BCa) confidence intervals (95%). There was a significant main effect of intervention on CAS scores, $F(1, 140) = 88.29, p = .001, d = 0.76$. The difference

between Intervention and Control schools was significant (p = .001) from T1 to T2 (see table 6.2) and was maintained at T3 (see table 6.3).

Table 6.1: Descriptive Statistics including bootstrapped confidence intervals with CAS T2 as the dependent variable and T1 scores as a covariate

			Bootstrap[a]			
					BCa 95% Confidence Interval	
School		Statistic	Bias	Std. Error	Lower	Upper
Intervention	Mean	106.3077	-.0149	1.2768	103.6938	108.7921
	Std. Deviation	10.62709	-.22764	1.48316	8.33884	12.75843
	N	65	0	6	55	74
Control	Mean	97.7051	-.0422	1.3353	95.0340	100.1452
	Std. Deviation	11.84215	-.10069	1.23618	9.55804	13.93262
	N	78	0	6	68	88
Total	Mean	101.6154	-.0444	.9651	99.7902	103.4333
	Std. Deviation	12.05908	-.06600	.94177	10.39268	13.70681
	N	143	0	0	.	.

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 6.2: Bootstrap for pairwise Comparison with CAS T2 as the dependent variable and T1 scores as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	14.668	.005	1.627	.001	11.414	17.952
Control	Intervention	-14.668	-.005	1.627	.001	-17.846	-11.579

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 6.3: Bootstrap for pairwise Comparison with CAS T3 as the dependent variable and T1 scores as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	10.467	.044	1.538	.001	7.591	13.593
Control	Intervention	-10.467	-.044	1.538	.001	-13.623	-7.581

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

6.4.2 GMC

A total of 139 children (74 students for control and 65 students for intervention) presented a full data-set at T2 testing using the coordination outcome measure; representing 93% of those from the original data set of 150 students at T1 testing. Missing data was minimal and imputation was therefore not applied. The data was not normally distributed and therefore bootstrapping was applied.

Table 6.4 shows the means and standard deviation (SD) for GMC from T1 to T2 and Bias Corrected Accelerated (BCa) confidence intervals (95%). There was a significant effect of intervention on GMC scores, F (1, 136) = 49.76, p = .001, d = 0.97. The difference between Intervention and Control schools was significant (p = .001) from T1 to T2 as shown in Table 6.5 and the effect was maintained at T3 (see table 6.6).

Table 6.4: Descriptive Statistics including mean and standard deviation for GMC T1 to T2 and BCa

			Bootstrap[a]			
					BCa 95% Confidence Interval	
School		Statistic	Bias	Std. Error	Lower	Upper
Intervention	Mean	18.5385	.0036	.1930	18.1686	18.9299
	Std. Deviation	1.58190	-.02088	.16912	1.27083	1.84669
	N	65	0	6	55	76
Control	Mean	16.5676	-.0084	.2794	16.0286	17.0907
	Std. Deviation	2.40480	-.02422	.21303	2.01923	2.76845
	N	74	0	6	63	85
Total	Mean	17.4892	-.0032	.1942	17.1223	17.8428
	Std. Deviation	2.27897	-.01029	.16050	1.98396	2.57344
	N	139	0	0	.	.

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 6.5: Bootstrap for pairwise Comparison with GMC T2 as the dependent variable and T1 as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	2.097	.005	.302	.001	1.546	2.730
Control	Intervention	-2.097	-.005	.302	.001	-2.754	-1.540

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 6.6: Bootstrap for pairwise Comparison with GMC T3 as the dependent variable and T1 scores as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	2.057	.005	.340	.001	1.384	2.718
Control	Intervention	-2.057	-.005	.340	.001	-2.715	-1.386

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

6.4.3 PAQ-C

A total of 146 children (78 students for control and 68 students for intervention) presented a full data-set at T2 testing using the PA habits outcome measure; representing 97% of those from the original data set of 150 students at T1 testing. Missing data was minimal and imputation was therefore not applied. There was no significant effect on levels of PA between intervention and control conditions $F(1, 143) = 1.66$, $p = .200$, $d = 0.24$. The difference between Intervention and Control schools was not significant (p = .199) from T1 to T2 as shown in Table 6.7 and this result was maintained at T3 (see table 6.8).

Table 6.7: Bootstrap for pairwise Comparison with PAQ-C T2 as the dependent variable and T1 as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	.125	-.002	.095	.199	-.080	.320
Control	Intervention	-.125	.002	.095	.199	-.312	.073

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 6.8: Bootstrap for pairwise Comparison with PAQ-C T3 as the dependent variable and T1 as a covariate

			Bootstrap[a]				
						BCa 95% Confidence Interval	
(I) School	(J) School	Mean Difference (I-J)	Bias	Std. Error	Sig. (2-tailed)	Lower	Upper
Intervention	Control	-.124	-.005	.228	.228	-.313	.052
Control	Intervention	.124	.005	.228	.228	-.116	.360

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

6.5 Discussion

We found a significant effect on cognitive performance at T2 which was maintained at T3 as a result of the BMT intervention. Similar significant effects as a result of intervention were identified for GMC at T2, and again maintained at T3. Previous studies have identified that improvements in motor coordination positively impacts children's cognition and the findings from this study support this (Adkins, D.L., Boychuk, J.,

Remple, M.S., & Kleim, J.A., 2006). However, what remains unclear is the nature of the tasks that children are being asked to perform in other intervention studies. Studies differentiate between whole body and manual dexterity functioning in children's coordination and the impact that this has on aspects of cognition (Niederer, I., Kriemler, S., Gut, J. *et al.*, 2011; Piek, J.P., Dawson, L., Smith, L.M., & Gasson, N., 2008). BMT intervention included both gross motor coordination and fine motor control tasks and therefore it is not possible from this study to evaluate the different impact that whole body or manual dexterity movements have on cognitive performance. The improvements in cognition in favour of intervention found in this study may be attributed to the design of the intervention specifically layering cognitive tasks onto coordination tasks throughout the PE lesson. From the present study it therefore remains unclear if the development of GMC led to improvements in cognition, or whether the direct targeting of certain aspects of cognition – specifically key executive functions (for example, working memory, inhibition and task-shifting) led to improvements in the CAS outcome measure. Previous evidence from the literature has shown links between specifically targeting executive function skills as a product of intervention with improvements in children's cognition and the findings from this study support this (Diamond, A.*, et al.*, 2007; Diamond, A. & Lee, K., 2011). However, these other studies have not taken into account improvements in GMC but have focussed on tasks of a sedentary nature that specifically target learning behaviours associated with executive functioning rather than integrating movement and thinking skills simultaneously. The findings from the present study therefore provides a unique insight into the value of directly targeting children's physical literacy and thinking skills in an integrated manner.

Previous literature has demonstrated complex associations between PA levels and executive function (Booth, J.N.*, et al.*, 2013; Castelli, D.M.*, et al.*, 2007; Fisher, A.*, et*

al., 2011). In a longitudinal study conducted by Booth *et al* (2013), findings contributed to recent conclusions from other studies (Guiney, H. & Machado, L., 2013) that PA is beneficial for some aspects of executive function. However, in the present study there was no significant effect identified with PA levels suggesting that any change identified in the CAS and GMC outcome measures may not be attributed to changes in PA levels. Studies have reflected that increased levels of MVPA in school-aged children does have a positive impact on their cognitive performance but findings from this study did not realise this (Khan, N.A. & Hillman, C.H., 2014). The cited studies used accelerometer data to measure levels of PA, and this is considered more accurate than self-reported levels of PA. It may be that the PA measurement tool used within this study was not sensitive enough to monitor change in PA levels and therefore could not account for any impact on cognitive performance from changes in PA levels. What we can say from other studies is that PA levels decline as children (aged 6 – 11 years) transition into adolescence (aged 12 – 19 years) (Long, M.W., Sobol, A.M., Cradock, A.L. *et al.*, 2013). The cohort of the present study ranged from ages 9- to 10-years of age at T1 and 10- to 11- years of age at T3. Thus the present study cohort were entering the transition into adolescence which may account for their reduced levels of PA from T1 to T3 across both control and intervention conditions.

The present results demonstrate that benefits from a novel approach to PE does improve children's cognition and coordination and that this improvement is maintained over time. The effect sizes from the data are large ($d = 0.76$ and $d = 0.97$ respectively) supporting the advocacy of BMT within schools, and may lead to educators and policy makers being more receptive to this delivery of PE in schools in Scotland. This is, however, speculative as teachers would require training in order to become proficient at delivering PE lessons that have the underpinning philosophy and methods of BMT at the core.

6.5.1 Limitations

While the present study had a number of strengths (the inclusion of a control group with pre-, post- and follow-up testing; large sample size; the nature of the sampling not having any exclusion criteria and therefore involving children with additional support needs as well as normally developing children; the objective measurement of cognition and coordination; and a high percentage of the original sample population presenting full data at post- and follow-up testing; and fidelity checks for data collection and scoring) there are also some limitations. One of these was the use of self-report using the PAQ-C to determine PA. Self-report measures are open to certain influences (for example, peer pressure) although the main researcher being there to conduct the testing will have helped to reduce this impact. Although previous studies have justified whole-class use of the PAQ-C, peer pressure may have exerted an influence on the results obtained (Niven, A.G.*, et al.*, 2007). Whilst the study has shown significant effects of intervention on cognitive performance, the absence of assessment of academic achievement limits an evaluation of the broader impact that improved cognition may have on attainment. Finally, what is not clear from the present study is the levels of activity that are achieved during a traditional PE lesson with that of the BMT lesson. It may be that children within the intervention condition achieved higher and more prolonged levels of MVPA during their 2 hours of PE each week compared with their control counterparts and that this may act as a causal factor in improvements in cognition. Therefore future work should try to capture both academic testing and MVPA levels during intervention to better understand the complex nature between PE, PA, coordination and children's cognition.

6.6 Conclusions

Children's cognition is impacted upon by PE with the nature of this impact affected by differing approaches to delivering PE. The significant effects of intervention identified within this study make a case for BMT to be considered as an approach to PE. However, further studies are required to understand the value that PE, PA and coordination have on children's cognition. In particular, further research is needed to examine the levels of MVPA being achieved during PE lessons, the improvements in gross motor coordination and fine muscle control and what benefit they may have on executive function and how this relates to improvements in academic performance over short, medium and long-term. Our findings point towards an exciting avenue of investigation for those who wish to investigate the value of differing approaches to the delivery of PE within schools. Subsequently, as executive function and cognition are often associated with developmental and psychological difficulties in children and adults (Micco, J.A., Henin, A., Biederman, J. *et al.*, 2009) and is related to the development of social and emotional well-being, (Zelazo, P.D., & Cunningham, W. A., 2007) findings which suggest improvements in these areas may have far reaching implications. If causal, these relationships may also add empirical support that encourage educators and policy makers with added incentives to promote daily PE lessons within our schools.

CHAPTER 7 – STUDY 2: A QUALITATIVE STUDY OF SCOTTISH STUDENTS' EXPERIENCES AND PERSPECTIVES OF BETTER MOVERS AND THINKERS (BMT)

7.1 Introduction

It is clear that there is a growing concern in the declining levels of physical activity (PA) that children are currently faced with throughout the world (Ekelund, U*., et al.*, 2012; Kohl, r.H.W*., et al.*, 2012). Sedentary living is a persistent and growing problem (McKenzie, T.L. & Lounsbery, M.A.F., 2014). Schools are well positioned to positively influence the health and well-being of students and potentially play a prominent role in addressing some of the health issues that children currently face (Ekelund, U*., et al.*, 2012; Kohl, r.H.W*., et al.*, 2012). However, this more likely to be achieved if the Physical Education (PE) curriculum delivers clear and meaningful outcomes for all students (McKenzie, T.L. & Lounsbery, M.A.F., 2014). PE has a central position in Scotland within the core curricular area of Health and Well-Being (HWB) as part of Curriculum for Excellence (Scottish Executive, 2004a). Despite such prominence Scotland has not yet reached the target of 80% of children aged between 2 – 15 years of age in Scotland participating in 60 minutes of PA (including school-based activity) seven days a week (Scottish Executive, 2003). Some of the cited reasons for children's low levels of PA include pedagogical approaches in delivering quality PE (Dyson, B., 2014), an inability for students to identify with the activities in PE (Scottish Executive, 2004b), teacher effectiveness (McKenzie, T.L. & Lounsbery, M.A.F., 2014) and a lack of fulfilment of basic psychological needs of autonomy, relatedness and competence (Mitchell, F., Gray, S., & Inchley, J., 2013). If the levels of student engagement are to be positively influenced then PE has to address these barriers.

Research has suggested that PE has the potential to play a key role in promoting PA in children and young people (McKenzie, T.L. & Lounsbery, M.A.F., 2014; Silverman, S., 2005). PE programme design and PE teachers' delivery of lessons are critical in positively shaping students' perceptions of PA and sport (Dyson, B., 2014). In order to alter student attitudes of PE and PA, changes and modifications are required to be made at both a curricular and pedagogical level (Dyson, B., 2014). PE has much to offer when developing the whole child including aspects that influence students social and moral development, cognitive development and students' sense of agency (Kirk, D., 2014; Reid, A., 2013). This is further supported by Dyson (2014) who states *'PE should not become some mindless physical activity.'* Dyson (2014) acknowledges that changes are required if we are to encourage our young people into living an active lifestyle. The experiences and perceptions of students when they participate in PE and PA in school does influence their levels of activity into the wider community and beyond their school years though there are conflicting views of this influence (Trudeau, F. & Shephard, R.J., 2005).

In designing PE programmes and delivering PE lessons student voice has been shown to be an invaluable source of information for teachers (Dyson, B., 2006; Erickson, F. & Shultz, J., 1992; Graham, G., 1995). Students' input into which activities they value, and enjoy most, may help to guide the modifications at a curricular level. Silverman and Subramaniam (1999) suggest that it is important to acknowledge and value students' opinions of PE, if positive changes in their attitudes to PE and PA are to lead to changes in their PA behaviours (Silverman, S. & Subramaniam, P.R., 1999). In listening and taking into account the perceptions and experiences of the students', it is more likely that effective programmes may be designed. However, Tinning (2010) states that a PE curriculum based solely on what students think is in their best interests may limit their educational experiences and therefore caution should be applied (Tinning, R., 2010). In

contrast Ryan and Deci (2000) make a valid case that in determining teaching approaches, teachers should include three key components of 'Self-Determination Theory (SDT);' *'competency,' 'autonomy'* and *'relatedness*' (Ryan, R.M. & Deci, E.L., 2000). Ryan and Deci (2000), suggest that individuals need to be able to self-regulate their actions and behaviours utilising intrinsic and extrinsic motivation as a guide. If students are able to have more of a voice on the design of their PE curricula, it could be argued that they would relate and engage more with the PE lessons on offer and in doing so experience greater levels of motivation encouraging increased levels of participation. The pedagogical approaches adopted by teachers when delivering such lessons should carefully reflect on the key components of SDT as they have been found to greatly influence decision making and behaviour modifications (Ryan, R.M. & Deci, E.L., 2000).

There have been some attempts at providing PE programmes that students can relate to through approaches such as 'Teaching Games for Understanding (TGfU)'(Werner, P., Thorpe, R., & Bunker, D., 1996) and 'Sport Education' (Siedentop, D., 1994) but these have typically (but not exclusively) been introduced at the post-primary stage at a time when young people are declining their levels of PA (Jess, M., Carse, N., McMillan, P., & Atencio, M., 2011; Tannehill, D*., et al.*, 2015). PA habits are informed within the earlier years of our life and therefore PE programmes in pre-school and primary school need to be re-designed if changes in students' perceptions and attitudes of PE are to be positively influenced (Sallis, J.F., Simons-Morton, B.G., Stone, E.J. *et al.*, 1992; Taylor, W.C., Blair, S.N., Cummings, S.S., Wun, C.C., & Malina, R.M., 1999). This is not to denounce or de-value the input that specific programmes (e.g. TGfU) can make in PE, but such programmes tend to focus on sports skills instruction (Jess, M. & Armour, K., 2011). In pre-school and primary PE students should learn generalised movement and behaviours that will transfer into other areas of their lives (Reid, A., 2013), yet sport is all too often

the main context in PE (Dyson, B., 2014). Whilst sport represents an important avenue for many children to be physically active it is not the only way, and during one's lifespan the opportunities to participate in sport decline for most people (McKenzie, T.L. & Lounsbery, M.A.F., 2014). There are many goals within PE with expectations on children's emotional, social and cognitive development as well as their motor skills, suggesting that PE has a wide reaching influence on the development of the whole child (Reid, A., 2013). To be effective the delivery of quality PE for all students throughout their school years needs to be enjoyable. However, designing a PE programme which positively impacts on all students learning, attitudes and perceptions is challenging (Prusak, K.A.*, et al.*, 2014). This is perhaps, in part, due to the lack of student voice when new initiatives and programmes have been introduced. A better understanding of students experiences within PE programmes could greatly influence teacher effectiveness and curricular design and address the needs of the students (Dyson, B., 2006; Mitchell, F.*, et al.*, 2013; Tannehill, D.*, et al.*, 2015)

One recent programme is "Better Movers and Thinkers (BMT)," an innovative approach to delivering PE. A quantitative study (see chapter 6) has identified significant gains in students' gross motor control ($p = .001$) and levels of cognition ($p = .001$) as a result of a 16-week intervention with gains being maintained at 6-month follow-up ($p = .001$). Results indicate that students' physical competency and cognitive development has been enhanced as a causal link to BMT. What is now required is to ascertain the students' perceptions of this novel approach. The purpose of this current study was to investigate students' experiences and perceptions of BMT. The inclusion of students' experiences and perceptions could help to inform the continued evolution of BMT as an approach to quality PE lessons and in doing so help ensure that this approach is both valuable and meaningful for students now and in the future.

7.2 Methodology

7.2.1 Focus Groups

Semi-structured focus group interviews were undertaken in each of the 3 primary schools immediately following the end of a 16-week intervention phase. Each focus group consisted of 8 students (4 boys and 4 girls), who were selected at random by their class teacher drawing their names from a hat. The focus groups were conducted by a researcher with relevant skills who was independent to every other aspect of the research design and who was not aware of the BMT approach. The focus groups were carried out in a quiet room, in each of the schools and lasted approximately 35 – 45 minutes. The researcher recorded the focus groups and provided the recordings for transcription purposes. Once the transcriptions were completed they were given to the same researcher who carried out the focus groups to evaluate accuracy helping to maintain neutrality of data collection. Each focus group session began with an introduction and a personal statement; 'Hi, my name is (Name) and my favourite flavour of ice cream is?' in order to make the students feel comfortable, to ensure the recording equipment was operational and to allow the different voices of the students to be identified for the purposes of transcription (see appendix A, B, & C) and analysis.

The researcher was provided with 3 main topics by the main researcher with some suggested questions to help discussions. These topics and three main questions had been used during the pilot study (see chapter 4) and were deemed appropriate for the main study. The topics included:

1. The experiences of the students during their PE lessons
2. Perception of what has been learned in PE lessons

3. Perceived transfer of learning from PE lessons to other subject lessons

The focus group interviews were recorded and were later transcribed by the main researcher for the purpose of analysis. The transcriptions were anonymised and checked by the independent researcher for fidelity prior to analysis being undertaken.

7.2.2 Participants

The students within the study (n = 24) were aged nine to eleven and were in their sixth year of primary school. Following ethical approval from the University of Edinburgh and the Local Authority where the study was situated, informed consent for the student to participate in the study was obtained from all parents, and informed assent was obtained from all of the students. Pseudonyms were used to protect the identity of all schools and students.

7.2.3 Context of the study

Each of the three primary schools were located within one local authority in Scotland. The local authority has a population of 337,950 people, has 48 primary schools and 27093 students attending primary schools (Scottish Government, 2015). Each of the schools was a public mainstream school and included those students who were registered with 'Additional Support Needs (ASN).' The class sizes and gender split of each of the schools can be seen in Table 7.1. Each of the three schools were in the moderate to least deprived areas according to the 'Scottish Index of Multiple Deprivation (SIMD)' (Scottish Government, 2015).

Table 7.1: Class roll and gender split

School	Class Roll	Boys	Girls
Intervention 1	28	7	21
Intervention 2	22	13	9
Intervention 3	20	12	8
Total	70	32	38

Prior to the study each of the three schools received its PE provision through a combination of experienced class teachers and PE specialists with a range of years teaching experience between them. For the purpose of this study we classify experienced teachers as those professionals who are fully qualified post-probationary teachers. Facilities within each of the schools comprised of one indoor space of similar size and some outdoor space, although the outdoor space varied between schools. The outdoor space varied from general school playgrounds (for example, combination of concrete and grass areas) to artificial third generation pitches. For the purposes of the study each school was asked to provide two 60-minutes PE lessons during the 16-week intervention phase, one in a morning and one in an afternoon.

Each of the three schools received the BMT approach from a PE specialist who had been previously trained in the intervention by the programme designers.

7.2.4 Data Analysis

This study used an iterative process to identify emerging themes to analyse qualitative data generated from each of the three focus groups (Creswell, J.W., 2007; Ritchie, J. & Lewis, J., 2003). Analysis was guided by grounded theory insights, which is described as a process of categorizing (Krueger, R.A., 2006; Strauss, A. & Corbin, J., 1998). Transcripts were read to generate analytical categories that emerged from each of the three schools. Attention was focused on the initial questions that provided the framework for the semi-structured focus group interviews to identify emergent themes before further analysis identified sub-themes.

The themes and sub-themes identified were used to analyse students' perceptions and experiences of their PE lessons following the 16-week intervention phase. Themes and sub-themes were coded separately for each of the transcriptions before being collated and

documented and sent to the independent researcher who carried out the focus groups for the purposes of fidelity. The data collected provides the basis for the information in the discussion and conclusions sections.

7.3 Results

Seven themes and twenty-four sub-themes were identified following analysis of the transcriptions (see table 7.2). Students who received BMT twice per week for 16-weeks provided comments that reflected the need for tasks in PE to be appropriately challenging, the influence competition had on their experiences, the social aspects surrounding PE, the need for their opinions to be sought and considered, the need to provide a greater variety of activities, the understanding of aspects that promote their learning and the transfer of that learning to other subject areas within their education, and finally, pedagogical factors that influence the quality of their experiences and perceptions of BMT.

Table 7.2: Main topics, Emerging Themes and Sub Themes

Main Topics	Emergent Themes	Sub-Themes
Experience of Students Perception of what was learned Transfer from PE to other subjects	Challenge	Repetition Level of challenge Emotions experienced
	Competition	Personal best Competing against other teams Competing with other people
	Cooperation	Working with others Fairness of team selection Different people to work with Attitude of others
	Student Choice	Not heard Not asked for Given chance to choose Creativity
	Variety of Activities	Increase number of activities Time spent doing one activity More games
	Learning	Similarities and differences From different sources Without being aware Working harder
	Pedagogy	Student perception of teacher Time spent in PE Use of resources/equipment

7.3.1 Challenge

Discussions that took place in each of the three schools identified a need for tasks to be challenging in PE. Students from each of the schools attributed a variety of emotions to challenge with some students' perceptions of challenge adding '*fun'* and '*enjoyment'* to their experiences as outlined during this exchange:

S1	Okay. So, what do you think of the things that are difficult like this activity?
S6	They're fun.
S7	They're challenging.
S6	Because you have to keep on doing it until you get it right so it was really fun.
S1	Okay. What does everybody else think?
S2	Challenging.
S1	Okay. Is that a good thing or is that a bad thing?
S2	It's a good thing.
S4	It's a good thing.

In contrast others felt '*frustrated'* and '*annoyed'* when they were unable to succeed with a specific challenge. For example;

S1	Okay. Anybody else thinking any different? Does anybody not enjoy things if they're quite hard?
S2	Sometimes.
S1	Okay. Why? What would happen if…in that kind of situation?
S7	Frustrated.

Students' comments indicated that when something was novel and new they had enjoyed these experiences as it encouraged them to engage with tasks. However they felt that tasks became quite repetitive and therefore became a little *'boring.'* As this exchange indicates:

S1	Okay, that's fine. So how did you feel when you were learning new skills and activities in PE? (Name)?
S4	I felt kind of good when I was learning new stuff to learn and do.
S1	Okay, so it made you feel good. (Name)?
S2	At the start, it was good but then, it felt good but then, when we kept doing it all over and over again, it kind of started to feel a bit boring-ish or something like that.

Contrastingly some students felt that when presented with enough time to go over and over tasks, they achieved greater levels of success eliciting emotions such as feeling '*proud'* or gaining in *'confidence*' as they recognised they were becoming more physically able. For example;

S1	You're happy. Okay. How did everybody else feel?
S3	Good about yourself.
S1	Good about yourself. Okay.
S2	A bit more confident.
S1	A bit more confident. Anything else?
S5	Pleased.
S1	Pleased. Okay. Pleased that you kind of managed to do it.
S6	It was good when you achieved it.

7.3.2 Competition

Students in this study defined competition as competing against other students and/or teams as well as competing to improve their own personal performance as captured in this exchange:

S1	Okay. And who are you competing against?
S4	Each other.
S5	Yourself sometimes. You get put into groups. And then, you have to do like the races and stuff.
S6	It's like normally four groups or three groups of about six or seven.
S1	Okay. (Name).
S5	You can sometimes compete by yourself like beating your personal best. That's what people were doing. Like you had to time it, say I got 13 seconds in one shuttle run, I might try and get 12 or 11 seconds on my next.

There were similarities between schools regarding the experiences students had when competing against others in PE indicating enjoyment when competition is an element within the lesson:

S3	It gets quite competitive sometimes.
S6	Yes.
S1	Okay. And how do you feel about if it's competitive?
S6	That's fun. (Overlapping Conversation).

Some students indicated that they would have liked to experience more competition, for example:

S1	Okay. So do you not have competitive things just now?
S6	No. Because I play football and at my age group. We don't get like a trophy. We just get like a medal. Everybody gets a medal for participating and what I would like to see in the future when I get older, it will be like competition and it will be competitive. And that's...I just can't wait until I get older and I can start being more competitive.

Competition was not always discussed in relation to team games and/or sports but in other activities within BMT:

S7	In our PE cupboard we have, like it's like these beanbag things. We used to use tennis balls for the juggling but I'd really like to...with the beanbags, you just like throw up and see how many times you can clap before it came down. And then, you could like see...like have a competition of who can clap as many times but you're only allowed to throw it at head height or something like that so it is kind of competitive at the same time.

7.3.3 Cooperation

Similar comments and discussions reflecting the value of cooperating with other students during BMT was indicated in each of the three focus groups. Many of the comments reflected the positive effect that working with others could have:

S1	Okay. And would you think of anything else? (Name)?
S5	Well, they bring, like...people that you wouldn't usually talk to or play with and you end up liking them more because you talk to them.
S1	Okay, so you get to work with different people?
S5	Yeah.

Other comments mentioned that through having to cooperate they were getting to know people and were understanding and beginning to appreciate other students. Some of the comments from the students reflected the supportive role that friends can offer when in PE:

Okay, (Name)?
Well when we...were like doing the knee accents, we had to like get a partner and coordinate and I think I learned that by... I never really 'understanded' it at the start, like how to go...because he said like just walk at the start and then knee lift. Well, me and my partner and my best friend....she used to like...we used to try and do it like together. We tried to like, when we lifted our knee up, it was like when you put it back down, that would count as one and we weren't counting that and we used to get like said all the time that's only four steps you're doing because we never knew that when you put your knee down, that's I think...that counts as one.

In contrast, one student indicated that cooperating could be a barrier to their enjoyment depending on the behaviour of other students:

S1	Okay. (Name).
S8	Well maybe some days it could be like...some people are misbehaving and we don't get on to our best bits and then you feel a bit sad because maybe one day we miss our tennis lot or one day we miss the mats coming out and then you feel like you've not really done anything in that lesson. Then you feel a bit like you're going to miss out on the next lesson.
S1	Okay. (Name).

7.3.4 Student Choice

Differences were evident in the comments received from the students with regards student choice. In each of the focus groups students made reference to their opinions within PE not being considered:

Okay, (Name)?
If they were to come back, they should actually ask us what our opinion, what we think. And if we wanted to play what game, if they were going to play a game.
Okay, (Name).

Students indicated that when their opinions and choices were being considered (for example, when there was an element of freedom to be creative in certain activities) that this helped add to their enjoyment of PE indicating that it encouraged them more when they were allowed an element of freedom to be creative in certain activities, for example:

Okay.
I think that's why people like the mats so much because you got to like do something different, it was your own, it wasn't like you were getting told.
Okay. So, do you prefer having kind of an input into different things? And does the change make it more interesting? How does...what kind of things did you do that you had control over that you could change?
Like what you wanted to do on the mats.
Or you could change anything you wanted as long as your group so, even if you didn't like something then, you could change it.

Students clearly valued the opportunity to be creative in PE, regardless of the activity that was being performed inferring that student choice was key to their enjoyment of PE:

We just kept doing it over and over again. Then, if you didn't manage to, then, the teacher would come and show. Because (Name) he kept on saying do it over and over again till you get it correct, for me and (Name).
We don't really have to do that with repetitive. It was more fun because we got to have, like adding our own hand sequence. And we got to go partners and see who could like make up sequences doing it. And then, whatever ideas was best you'd show it to the class.

7.3.5 Variety of activities

Discussions centred on the range of activities and sports that were being offered during the 16-week intervention phase. Some students felt that more activities were needed and that time should be reduced when focusing on the same activity for too long:

Okay, (Name).
I'd like to see...I'd like to play...street hockey just on the AstroTurf just have a feel of what it's like because I've never played hockey ever.
Okay, (Name).
I always like...really like gymnastics and everyone would get excited like when they pulled the mats out so that we could do our sequences. So maybe like in primary seven we could have like maybe one day we could do like focus on basketball and then the next day we could have a full day of gymnastics.

Students made positive reference to participating in something novel, as this encouraged their engagement with PE and produced a positive experience of PE, for example,

It was different because you didn't always do the same thing. So, if you were able to do the easy one, there was a harder one. If you could do that, there was an even harder one. So, there was always something else that you could do, if you could do something.
Okay.
It was good 'cause you hadn't had it before.

7.3.6 Learning

Students' recognised that they learned in different ways during PE, for example, through teacher demonstration and through practice as highlighted with these two quotes:

Okay. So you've talked about a few different things that you learned. Could you give me an example of what you were learning and how you learned it? That's quite hard to think about but you talked about being able to do things that you couldn't do at the start so you managed to learn it so how did that happen? (Name)?
Well, the teacher would show you it and then you would repeat it again and then you would do it step by step. And then after you've done it a couple of times, you would like speed it up a bit and then slow it down a bit and then the more you have done it, the more that you improved on it and you learned it more and you're able to do it.

Okay, so how... (Name)?
By...because we...we had to keep doing it week by week until we've learned it. Then, we'd stop and move on to another sport that I learned by trying harder and harder and harder.
Okay, (Name)?

There were discussions around the similarities and differences between learning in PE and learning in the classroom with some comments from students indicating that they failed to learn anything in PE:

You didn't really learn that much that you couldn't do already. It was basically just running about doing movements that you knew.
And you didn't learn like skills that could help you in general life.
Okay.

Yes. What kind of things did you learn about?
We haven't really learned much, we just learned to do stuff. Well, to juggle, that's all.
Okay. So different movements.

Other students' comments were more positive about their experiences of learning in PE:

Okay, so you like the climbing frame and the kind of challenges that you went across then? What do you think you've learned in your lessons from the beginning of January this year? (Name)?
All those sequences I learned those are quite cool and fun to do.
Okay, (Name)?
Well, I learned to do it, things slightly more challenging. And before I couldn't do two things at once when we we're like two to two, to right to two to right to two to two and doing things with our feet at the exact same time because we're going to move at the same time and with rhythm.
Okay, so you learned the patterns with your arms and you started to learn to be able to do different things with your arms and your feet to a certain rhythm. Okay, are there other things that you've learned? (Name)?
I've learned more stuff I can do when I've got free time to go outside and do it.
Okay, what kind of things?
Like go and practice running and my...what I learned in Better Movers Better Thinker and what I've learned there.
What did you learn? What have you learned? (Overlapping Conversation)
Like all the sequences and all that and the tennis tricks we've learned and all that, the juggling.

Results indicate that some students were able to relate some aspects of their learning during PE to learning in other contexts:

Okay, (Name)?
Sometimes, if you do, let's say, maths, Ms. (Name) would put in a clap sequence with it just to kind make it fun and I would kind of like relate to better movers, better thinkers because the same things are going on but then, it's good because we get to play a wee game before maths and then we would get in like our clap sequences or we'd do a clap...like a wee pattern or something. It would be quite good.
Okay, so that is something that is quite similar. How would you think that helped? Do you think that helped in maths or is it just fun?
I think it sort of helped you remember your tables because if you've done the times tables, let's say, the square, cross, cross, square, you would remember like eight nothings are nothing, square, cross, cross, square would help you remember the number and the tables.

In contrast some of the students were quite clear that learning during PE and learning in class were completely different, for example:

Okay, so how is learning in PE different from the other lessons that you might do in class? (Name)?
Because you learn a different kind of...because you're learning about different things.
Okay, so can you expand on that a little bit?
Well, like if you learn about PE and movement and all of that, in class, you're sitting down, you're learning about language and maths and all that so it's different.

7.3.7 Pedagogy

Students' comments focussed on three specific areas; the expertise of the teacher, the time spent in PE and the use of equipment and resources. Students' perception of teacher expertise provided an interesting insight into how this shapes the experiences of the students in PE.

Okay. (Name).
If you don't...if you didn't like something during PE, you...the more the PE specialist taught us, the more we started getting into it and then we started liking it. I think that's what made everybody start bringing in their PE kits…..

Similarly the approach fostered by the teacher during BMT also influenced the students' experiences:

Well one of the good things about like the teachers in Better Movers and Thinkers they encourage you. Like if you got fed up of doing it and said, “Oh, I can't do it.” They say, “No. Just try again, try again.” And you would end up getting it.
Okay. So, is that different to other?
It's different to some teachers and some other people that come and they just like give you a task. And then, when they come in to see, they say, “Oh, no. You’re doing it all wrong,” and stuff. Instead of saying...like maybe saying, “That's really good. Just try and improve on it,” or something.
Okay.
Or they don't really help you some of the other teachers. But they like gave you a tip and then said, like will leave you and come back in a few minutes and like some people have worked it out. And then, by that time, you probably have worked it out because the thing they gave you was really good even though it doesn’t seem.
Okay. So, sometimes they gave you like a wee tip, and that helped you, helped you improve. That was all you kind of needed to get it. (Name)?
It's like kind of like a sandwich thing. They’ll tell you something good and then, they’ll tell you something bad and something good. There's more good things than there was the bad.

The approach adopted was not always positive, however, and some of the students commented on the teacher taking too much time to talk to the class, giving them less time to be actively involved in their PE lesson:

They brought us...like we weren’t getting enough time to practise, they’re like, “Let’s go out for a bit.” And then they would bring us back in and then tell us what to do and then they do a sample of that and then it’s like...we already know what to do. And then they keep talking and we didn’t really get that much time to do the stuff that we were doing and we all had ideas for it.
Okay, so you didn’t get enough time to actually do things. There was too much chat from the teacher?
Mm-hmm.

When time was afforded to being physically active, students described that they often practiced something for a long time but didn’t then play games:

See on the last day of better movers, better thinkers, I think we should play the game because we had to do all the work for the months and that.
So you had to show all your parents what you’d learned?
No, we had to do all the stuff in gym and didn’t get to play a game, so I think we should have played on the last day so we could have a little bit of fun at the end.

Related to this students commented on the lack of use of the equipment, for example:

Well in our PE cupboard, we've got a lot of like stools and you can like a…like years ago we used to jump off them, and then we get horses. It's like it always sits in there and we don't... I always like to bring it out and have a chance to play with it just so that we can try something new.
Okay, so we like to try new things. (Name)?
In our PE cupboard we have, like it's like these beanbag things. We used to use tennis balls for the juggling but I'd really like to...with the beanbags, you just like throw up and see how many times you can clap before it came down. And then, you could like see...like have a competition of who can clap as many times but you're only allowed to throw it at head height or something like that so it is kind of competitive at the same time.

7.4 Discussion

The results from the focus group interviews suggest that tasks need to be challenging in PE as this contributes to students' experiences in PE. From the results it is apparent that the level of challenge, the time spent focusing on any one challenge and the ability to handle a range of emotions associated with these challenges (for example, happiness from success, disappointment from failure) seem to influence students' enjoyment of BMT. BMT offers challenges that appear to capture the engagement and enjoyment of students but this was dependent on whether the students achieved a level of success within a specific time frame. These insights suggest that students' need a connection to a task if they are to persist and remain engaged with it long enough for their physical competency to improve. What is unclear is how long students feel they need to endure with a task before they can become proficient at it or before it becomes too repetitive and they disengage.

Research would suggest that among other things, the level of optimal challenge influences student motivation, engagement and enjoyment in PE (Pesce, C*., et al.*, 2013). In conjunction, the time spent working at a task is influenced by motivational factors, both intrinsic and extrinsic (Ryan, R.M. & Deci, E.L., 2000). Within this study the intrinsic factors identified from the data were associated to the level of challenge and students' feelings and emotions surrounding the challenge such as fun, enjoyment, frustration

and/or annoyance. Extrinsic factors identified within the results suggests other factors as an influence on students' enjoyment and engagement in BMT including; competition, the range of activities being experienced, and the approach adopted by the teacher with no evidence of a hierarchy of which had the most significant influence.

Research has indicated that the inclusion of competition in PE can be both a positive and a negative influence on student engagement in PE and this study supports these findings (Azzarito, L. & Ennis, C.D., 2003; Barker, D., Quennerstedt, M., & Annerstedt, C., 2013; Koekoek, J. & Knoppers, A., 2015). Interestingly, students in this study cohort appeared to focus more on improving their own performance rather than competing against their peers which may be a result of the nature of the intervention itself and/or the way competition was delivered by the teacher. This raises questions about the influence of significant others to students' experiences and perceptions of BMT.

Interactions with significant others (for example, peers, teachers, sporting heroes) does seem to contribute to student levels of motivation and is supported in this study as indicated through the positive and negative comments provided by the students (Carr, S. & Weigand, D.A., 2001; Dyson, B., 2006; Urhahne, D., 2015). For example, the opportunity for students to swap and share ideas for tasks during their lesson was viewed as positive motivation whereas the misbehaviour of others was viewed as demotivation as it prevented certain aspects of the lesson being experienced by students (i.e. playing a game). Results from other studies have outlined that the involvement and cooperation of significant others can positively and negatively influence students experience in PE (Carr, S. & Weigand, D.A., 2001; Koekoek, J. & Knoppers, A., 2015). Results in this study had similar findings as for some students their peers helped enrich their experience, as working alongside their peers enhanced their physical competency, whilst others felt the behaviour of their peers was a barrier to the enjoyment that they experienced. Students

in each of the three focus groups were aware of the social interactions in lessons with evidence indicating that students in general valued the chance to work and cooperate with one another. Results suggest that students were able to recognise and distinguish between the characteristics that allow this cooperation to be advantageous as well as disadvantageous. These observations typically referred to the students' interactions with their peers, as opposed to their cooperation and interaction with their teachers.

Students' remarks on aspects of pedagogy indicated that the approach adopted by the teacher was significant to the experience they had of BMT. This is similar to findings in other studies that discuss different approaches adopted by the teacher and how this influences students' experiences in PE (McKenzie, T.L. & Lounsbery, M.A.F., 2014; Prusak, K.A*., et al.*, 2014; Urhahne, D., 2015; Weiss, M. & Stuntz, C., 2004). Students in this study cohort felt they were allowed a level of independency for their learning in BMT and, perhaps subconsciously, this gave them ownership of their learning and thus developed and enhanced their '*autonomy'* and '*relatedness'* for the tasks during lessons (Ryan, R.M. & Deci, E.L., 2000). This is not unique to BMT, however, the design of BMT specifically focuses on giving the responsibility of learning to the learner aligned with a direct focus on the development and enhancement of EF skills (Education Scotland, 2015c). Research has indicated the many benefits that can be attributed to good EF skills with particular reference to aspects of cognition, emotion and learning (Diamond, A*., et al.*, 2007; Diamond, A. & Lee, K., 2011; Micco, J.A*., et al.*, 2009; Monette, S*., et al.*, 2011). Studies have indicated that those students' with more developed EF skills are able to demonstrate, among other things, better levels of self-regulation (Hofmann, W*., et al.*, 2012). In addition, research has shown that if teachers adopt a more autonomy supportive role that this encourages the use of good self-regulation fostering greater levels of curiosity, intrinsic motivation and desire for

challenge (Flink, C.*, et al.*, 1990; Ryan, R.M. & Grolnick, W.S., 1986). In direct contrast, students whose experiences are with teachers who adopt a more controlling approach lose initiative and learn less effectively (Grolnick, W.S. & Ryan, R.M., 1987; Utman, C.H., 1997). BMT encourages improved self-regulation allowing for a more autonomy supportive learning environment with specific focus on the development of EF skills (Education Scotland, 2015a). It may be that students' who receive BMT are likely to have improved self-regulation as a result of this. This could account, in part, for a better student experience in PE, however, it is out with the scope of this study to evaluate if the students' receiving BMT did develop better self-regulation.

Results suggest that the range of activities and sports being offered during the 16 week intervention phase were not varied enough for some students. Students felt they needed to experience a wider range of activities and sports rather than focusing on one activity for what some students perceived as '*too long*' with some students indicating that tasks were too *'repetitive.'* Contrastingly, some students felt it was important to repeat tasks until they felt they were proficient at it. Physical competency has been identified as a major influence in the value students place on their PE experiences (Dyson, B., 2014; Tannehill, D.*, et al.*, 2015). The results from the main study (chapter 6) have shown significant gains in gross motor control as a result of intervention when compared to the control condition schools. This may be due, in part, as a result of BMT specifically targeting the development of complex motor control. It is therefore possible to consider that students' experiences and perceptions of PE have been positively influenced by BMT as it has been shown to encourage greater gains in students' physical competency. Caution is required, however, as there is no evidence within this study to suggest a relationship between improvements in gross motor control and more positive student perceptions of PE as a result of BMT. As has been outlined previously, the levels of

challenge, cooperation, competition and pedagogical approaches have all contributed to students' perceptions of their PE experiences. It does present an opportunity for further research to ascertain if the students perceived improvements in their physical competency as a result of BMT, has positively influenced their perceptions and experiences of PE.

The seven emergent themes and their sub-themes identified key areas that helped inform the current research about students' experiences and perceptions of BMT. Refinement of BMT should carefully reflect on students' feedback and perhaps consider more variety in the activities being experienced by the students during BMT. With respect to the content within each lesson, the variety of activities being experienced and the time spent participating in each physical task seemed to provide conflicting views. Future developments in BMT may need to provide a wider range of tasks and activities being experienced by the students during their PE lessons to address the negative influence on student enjoyment that has been found as part of this study. What is not clear is if the choice of task and/or activity should be student led or teacher led, and it has been out with the scope of this thesis to evaluate this aspect. However, lesson from other studies suggest that the choices made by students do not always reflect their best interests and therefore caution is required when affording too much student choice to their PE lessons (Tinning, R., 2010). For example, some students were pleased to have time to learn and develop in tasks and activities whilst other students wanted to move on to other tasks and activities quicker. The intervention phase within this study was 16 weeks allowing for 32 lessons to be experienced by the students and as a result limits the amount of variety that can be made available. In contrast a full academic year accounts for approximately 36 weeks and a possible 72 lessons and by its very nature provides more time for variety to be experienced. It may be argued that if students experienced a full academic year of BMT

that the issues around time spent on one task and the range of activities being experienced may be addressed as a matter of logistics.

7.5 Conclusion

Students' perceptions and experiences of BMT are influenced by key factors including; challenge, competition, cooperation, student choice, range of activities, learning and pedagogy. The perceptions and experiences of the students are varied highlighting the variety of need that is required in PE. Within current research there are many reasons cited indicating the value that PE has to offer, all of which is best captured when considering Reid's (2013) perspective as he outlines that PE is about much more than just the development of physical competency, sports skills or health (Reid, A., 2013). PE is about the development, enrichment and engagement of the whole person helping place PE at the heart of any curriculum (Reid, A., 2013). What is important is that we learn the lessons from studies such as this and use the knowledge gained to help inform curricula and policy.

CHAPTER 8: CONCLUSIONS, PRACTICAL RECOMMENDATIONS AND FUTURE RESEARCH DIRECTIONS

8.1 Introduction

The thesis has provided an exploration of an innovative approach to Physical Education (PE) known as Better Movers and Thinkers (BMT) on children's coordination and cognition with consideration of physical activity (PA) habits. The literature identified and explained factors that influence student engagement within PE and whilst the information does not provide an exhaustive list, the key factors that have been considered include: the early experiences and development of children; the influence of the family and socio-economic status on children's future opportunities; the impact of motor development on children's abilities to engage with PE; the need to enhance students' willingness and ability to participate in PE using knowledge from 'Self Determination Theory (SDT); and the impact that teachers can have on students' motivation and enjoyment of PE.

Further, the thesis takes into consideration the importance of EF skills and how these relate to different aspects of development and the learning process. The literature has informed this research identifying the interrelationship between motor development and cognitive development which provides some justification for PE being an important element of educational curriculum in schools. The Scottish government has introduced a policy recommendation that all children aged 5 – 11 years within primary education receive two hours of PE each week and children aged 12 – 18 years in secondary education with two periods of PE each week. This suggests that PE is regarded as an integral part of mainstream education, with both policy and legislation addressing the health and wellbeing agenda in Scotland by encouraging Scottish children and young

people to become more active and to stay more active. Whilst PE can support the health and wellbeing agenda, there is evidence from past and current research that PE has far wider reaching benefits to children and young people including the development of their social, emotional and cognitive competencies.

The design of a PE programme that can provide such a wide range of benefits for all has been difficult. This thesis has evaluated the impact that BMT has on children's cognition and coordination whilst also considering PA habits. In addition, the current research has gathered students' experiences and perceptions of BMT to evaluate how well BMT has been received as an alternative approach to PE in schools. This has been achieved in the study outlined in chapters 3 and 4 and extended in the main study in chapters 5, 6 and 7. Findings from these studies has informed the practical recommendations and future research directions as outlined below.

8.2 Summarising the Original Research: Chapters 3 & 4 (Study one)

Study one had the primary aim of evaluating the feasibility of BMT as an approach to PE within primary education. The secondary aim was to investigate the perceptions of students and their class teacher of BMT as an alternative approach to PE. The findings from this study revealed statistically significant improved overall score changes in measures of working memory, phonological awareness and segmentation abilities in students' recruited to the intervention condition. Significant group by gender interactions further revealed that boys in the intervention condition made greater gains than boys in the control condition in phonological, segmentation and spelling abilities. The quantitative findings revealed in this study suggest a potential mapping between BMT and improved academic skills.

Qualitative findings indicated that students enjoyed BMT as an alternative approach to PE with the class teacher making particular comments with regards to the engagement of girls in PE. In addition, the class teacher felt that BMT enhanced aspects of classroom learning.

In summary, findings suggest good feasibility of BMT as an alternative approach to PE in primary education with concomitant benefits to academic and EF skills. In identifying limitations of the study, a larger scale study was required to include a larger sample size and PA as an additional outcome measure. This helped to identify if changes in PA could account for any changes identified in study one.

8.3 Summarising the Original Research: Chapters 5, 6 & 7 (Study Two)

Study two aimed to evaluate if there were links between BMT and cognition and GMC, and to identify if there was a correlation between levels of PA and cognition. In addition study two aimed to gain further understanding into the perceptions and experiences of students and teachers of BMT as an alternative approach to PE. The study had four main research questions in order to achieve the stated aims.

The design of the study, including outcome measure selection, length and delivery of the intervention phase and testing protocols were informed by identified strengths and limitations from study one.

Findings from the study revealed statistically significant improved score changes from pre- to post-test on coordination and cognition and that the score changes were maintained after 6-months in the students who were recruited to the intervention condition. There were no significant score changes in PA habits in students recruited in both conditions suggesting that BMT and current PE provision did not influence students' levels of PA after 16-weeks of intervention or at 6-month follow up.

Qualitative data identified seven emergent themes that informed the understanding of students' experiences and perceptions of BMT. Overall these themes provided support of BMT as an alternative approach to PE within school. The results outlined that tasks in PE need to be challenging but that careful consideration as to the level of challenge, the time spent focusing on one challenge and the range of emotions during these challenges needs to be considered as these aspects influenced students' enjoyment of BMT. Other aspects influencing students' enjoyment were; competition, the range of activities and the approach adopted by the teachers' when delivering BMT.

In summary, findings suggested that there is a link between BMT and coordination and cognition but this is not mediated by PA levels as indicated in similar studies. In addition, there were no mediated relationships between improved coordination scores and improved cognitive scores. In contrast to study one, there were no specific group by gender interactions identified.

8.4 Summary of Findings in the Thesis

The findings identified within study one and two provide evidence that BMT is feasible to deliver as a PE programme within education. The links between BMT and potential gains in academic skills, EF skills, coordination and cognition reveal promising results that may help to substantiate PE as an integral part of mainstream education, and more specifically with the raising attainment agenda. The experiences and perceptions of students and teachers of BMT as an alternative approach to PE are positive. There are some aspects that need to be considered with future developments of BMT with the specific objective of sustaining the engagement of students in PE throughout their school years. In light of these findings there are some practical recommendations that we can draw from the current research.

8.5 Practical Recommendations

There are varying needs for students to become more physically educated ranging from students' who need to access physical competencies to raise their self-esteem to those requiring enhancement in order to perform as top level athletes at a national and international level within their chosen sport. Although latest figures show promising results as more schools are achieving the 2 hours/2 periods each week of PE for all students following the introduction of the Scottish government's policy recommendation, the quality of PE that students experience is varied. This variety is thought to be a consequence of different levels of training opportunities for teachers and relates to teachers confidence and competency in delivering a positive PE experience for students. If BMT is to be considered as an approach to addressing the quality of PE experience for students, investment into staff training and in the production of supportive resources needs to be a priority.

Education Scotland has shown a commitment to the professional development of teachers in primary and secondary education by providing a combination of National Events, Summer Schools, mentoring programmes and the production of an online resource specifically on BMT (http://www.educationscotland.gov.uk). These training opportunities and resources have significant links to Significant Aspects of Learning (SAoLs) and Curriculum for Excellence (CfE) and align with current curriculum and the Scottish governments' policy legislation. The results from this thesis may also influence the content of Initial Teacher Education (ITE) courses in due course.

8.6 Future Research Directions

The thesis has provided an exploration of an innovative approach to PE (BMT) on children's coordination and cognition with consideration of PA habits and has identified promising results. However, upon critically reflecting on the methodologies used within this research there are some limitations to consider when designing future research into the impact of BMT on children. Along with the results, the strengths and limitations identified in chapters 4, 6 and 7 have helped inform additional elements that should be considered in potential future research directions into the impact of BMT as an alternative approach to PE.

8.6.1 Moderate-Vigorous Physical Activity Measurements

The use of self-report PA habits, although reliable, is limited as there is often considered to be an element of over-reporting (Bowles, H., 2012; Bull, F., Maslin, T., & Armstrong, T., 2009; Chinapaw, M., Mokkink, L., van Poppel, M., van Mechelen, W., & Terwee, C., 2010). Future research should include objective PA measurement such as the use of accelerometers. In addition, further studies into the impact of BMT on student's coordination and cognition should include a measurement of the levels of PA students achieve during their PE lesson as this could be a mediator for changes in cognition as identified in other studies of this kind. This is a clear limitation of the current research, although the inclusion of objective PA data was out with the pragmatic constraints for data collection in this research.

8.6.2 Longitudinal Studies

Study one identified improved score changes in specific academic skills and EF skills in students recruited to the intervention condition. What was not identified was if these effects were maintained over time. Study two addressed this by including a 6-month

follow-up testing where improved score changes in cognition and coordination were found to be maintained. However, the influence of maturational changes both neurologically (i.e. neural plasticity) and physiologically (i.e. pubescent stage of life) as well as other life factors (i.e. socio-economic status, family structure, parental education etc.) requires careful consideration. Future research into the impact of BMT as an approach to PE would do well to consider a longitudinal study that follows students' throughout their primary and secondary education whilst considering a multi-factorial design to take into account other covariates that similar research has outlined.

8.6.3 Academic Attainment

Although study two identified improved score changes in cognition, the limitations within this study did not evaluate if improvements in cognition transferred to improvements in academic attainment. Future research should therefore include measurements of numeracy and literacy (i.e. national standardised assessments) to ascertain if there is a positive correlation between improved changes in cognition and subsequent changes in academic attainment.

8.6.4 Functional Magnetic Resonance Imaging (*f*MRI)

Improved change scores in cognition suggest improvements in particular areas of cortical functioning (i.e. EF skills). These cortical changes may be interpreted as increased connectivity or increased activation between motor and cognitive locations in the brain as a result of physical exercise and activity, but study two can only suggest this as a possibility. The introduction of *f*MRI would allow an actual measurement of any changes in brain connectivity and would provide a significant insight into the actual impact of BMT at a neurological level and in doing so address gaps within current research into the links between PA and cognition and academic achievement.

8.7 Personal Learning Reflections

During my time as a researcher I have become increasingly more accustomed for the need in having a plan A and a plan B. I have recognised that through this process of growth, knowledge and understanding that occasionally a plan Z is required. As a researcher I have met many obstacles and have discovered that with increasing endeavour, enthusiasm and dogged determination, they can be overcome.

The use of a mixed methods approach is something I had not considered in the past but having completed this part of my journey, as a research professional, I increasingly see the importance of quantitative and qualitative data and the richness that they serve together in explaining the interrelationships between theories and realities.

In the field of education teachers are under increasing pressures and are continually challenged to raise learner's attainment and achievement. Research is an invaluable field at finding solutions to help achieve this. During these last 3 years I have learned the value of research as a process and have used this when working alongside teachers, helping them to see the relationship between theories and practice.

I have discussed with colleagues the impact of my research and this has been the greatest driving force within my thesis. I continue to grow an increasing passion for wanting the PE experiences of all school-aged children to be as rich and as positive as possible. Surely this is the least that children deserve?

This is a journey I have been frustrated by and enthralled by. I have grown into a better human being and have truly learned the importance of team work both professionally and personally. I finish this thesis in the hope that this is only the beginning.

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APPENDIX A –
Intervention school 1 focus group transcription

Intervention School 1 Focus Group Interview

Duration 44 minutes 04 seconds

Speaker key

S1 Speaker One (Facilitator)
S2 Speaker Two
S3 Speaker Three
S4 Speaker Four
S5 Speaker Five
S6 Speaker Six
S7 Speaker Seven
S8 Speaker Eight
S9 Speaker Nine

Timecode	Speaker	Transcript
00:00:00	S1	Okay, so that's both of the recordings started. So, first of all, can you tell me a little bit about what you've been doing in PE since the beginning of the year, so, since January. I'll tell you what. Why don't we go around the table, first of all and introduce ourselves and just get ourselves used to speaking on the tape. So, first of all, if we all go around, we say our name and then can we say what our favourite flavour of ice cream is. Okay, so my name is (Name) and my favourite ice cream is cherry. Okay, so we're going this way.
00:00:42	S2	My name is (Name) and my favourite flavour is raspberry ripple.
00:00:46	S3	My name is (Name) and my favourite flavour is mint.
00:00:51	S4	My name is (Name) and my favourite flavour is vanilla.
00:00:57	S5	My name is (Name) and my favourite flavour is chocolate.
00:01:01	S6	My name is (Name) and my favourite ice cream is vanilla.
00:01:05	S7	My name is (Name) and my favourite flavour is strawberry.
00:01:09	S8	My name is (Name) and my favourite flavour is raspberry ripple.
00:01:13	S9	My name is (Name) and my favourite flavour of ice cream is chocolate.
00:01:16	S1	Wow, lovely. Okay, so now, thinking a little bit more about PE. Can you tell me the types of things you've been doing in your classes since January? Okay, (Name)
00:01:31	S4	We've been doing sequences and like accents and knee lifts and all that.
00:01:39	S1	Okay, so what kind of sequences do you do? (Name)
00:01:44	S7	You have to include balance, flight and movement and travel, I think, it is.
00:01:52	S1	Okay, what other things have you been doing? (Name) you were going to say something, I think.
00:01:57	S6	We've been doing clap patterns.
00:01:59	S1	Clap patterns? Okay, lovely. (Name)
00:02:04	S8	We've been doing sequences.
00:02:06	S1	Okay, so is that the same? Is that different things?
00:02:09	S8	We get, like, the mats and we do the things that (Name) said like the flight and the balance and the travel.
00:02:15	S1	Okay, (Name).

00:02:18	S3	We've been juggling, like, tennis balls and hitting it trying to keep up and bouncing that and try to put the tennis racket down and catch it.
00:02:27	S1	With the tennis ball? And juggling?
00:02:29	S3	Mm-hmm. Hit it in the air.
00:02:31	S1	Okay, lovely. (Name)?
00:02:33	S5	We've been doing a lot of gymnastic related things and tennis and things like throwing balls in the air and then we got rackets for a few times and you had to like keep hitting it up and then curving it, the ball. And then we got gymnastics, we brought bag mats and then we had to do roly-poly's and do our own sequences with partners.
00:02:59	S1	Okay, so is there any other types of things that you do in groups or with partners? (Name)?
00:03:07	S8	Well we did volleyball, was that at the beginning? And we threw things, like, balls to each other and then we, like, made up a sequence where we do things with the balls.
00:03:20	S1	Okay, so you made up sequences with the volleyballs with each other? Okay, are there any other activities that you do that you could think of? Anything different? (Name), you were going to say something?
00:03:36	S7	We do a thing that's like cross, cross, cross, square.
00:03:40	S3	Square, cross, cross, square.
00:03:42	S1	What's that?
00:03:44	S5	It's like this...
00:03:44	S3	We do a sequence and...it's like...
00:03:46	S7	Square, cross.
00:03:47	S3	Like...and we use it for our maths sometimes as well. So the times tables and we go like that.
00:03:52	S7	Square, cross, cross, square.
00:03:53	S1	Okay, so that's kind of movement across your body. And you use that in class and in PE?
00:03:59	S7	Mm-hmm.
00:04:00	S1	Okay, that's interesting. And what else, somebody was going to say something then, I think, before...was it like...(Name), you were going to say something?
00:04:08	S7	We do like, mirroring sequences.
00:04:12	S1	What's that? Sorry. (Overlapping Conversation) mirroring sequences. Okay, so do you do that with a partner?
00:04:16	S7	Yeah.
00:04:17	S1	And you have to copy each other?
00:04:19	S7	When we make up a small sequence with four or five things in it and then the other one would repeat...and then they would do the same thing and then repeat.
00:04:29	S1	Okay, so you've told me lots of different things that you've been doing in PE. What do you think about these types of activities? (Name).
00:04:42	S4	They're quite enjoyable to do and they're quite... There were activities to get you fit and better thinking.
00:04:54	S1	Okay, so you quite enjoy them and you think that they help you get fitter and improve your thinking?
00:05:02	S4	Yes.

00:05:03	S1	Okay. And would you think of anything else? (Name)?
00:05:06	S5	Well, they bring, like...people that you wouldn't usually talk to or play with and you end up liking them more because you talk to them.
00:05:14	S1	Okay, so you get to work with different people?
00:05:16	S5	Yeah.
00:05:17	S1	Okay, that's nice. What else? What else do you think about them? Are they easy? Are they hard? Are they fun? (Name)?
00:05:32	S8	When we were doing like the square, cross, cross, square, at first, it's really hard and then when you practice it over and over, it gets quite easy.
00:05:41	S1	Okay, Can I just ask you all to make sure you speak up so that I can hear it on the tape recorder because it's quite noisy outside. So, sometimes, they're quite hard at the beginning and you've got to practice them. How do people feel about things that are quite hard at the beginning? Lots of hands, I like this. (Name)?
00:06:00	S9	Sometimes, when you're in a group and some of the other people know it, they help you and then it gets easier and sometimes like the gym teacher helps you if you don't know how to do it.
00:06:15	S1	Okay, who else was going to say something then about what...how do you feel when they're hard, to begin with? (Name)?
00:06:23	S8	Well, like...I was going to say really what (Name) was gonna say.
00:06:28	S1	Okay, anything else? (Overlapping Conversation) (Name)?
00:06:31	S4	(Name), feels kind of...it feels hard at the start and then it gets simpler every week they do it. And mostly, felt like if you start tennis one week, you do it for three weeks and then you do something fun stuff and then you do something else.
00:06:55	S1	Okay, (Name), what were you going to say?
00:06:56	S3	No.
00:06:59	S1	You forgot? Okay, that's fine. So, you kind of said some of the things are fun but sometimes are quite hard but you practice them. You might get help from other people and it gets easier as you do that through the weeks. What else do you think about the activities that you're doing? (Name)?
00:07:17	S8	Well, they can get a bit repetitive after a while because we did tennis for about six weeks? I don't know. We did that for a really long time and then a lot of us could do it and just wanted to move on.
00:07:33	S1	Okay, so, sometimes, it gets too easy?
00:07:36	S8	Yeah and then like when we were doing... Normally, we would do one, two, three, knee. We would do that every single week and we thought that was a bit boring.
00:07:46	S1	Okay, does anybody else think that? Boys at the top? (Name)?
00:07:51	S7	Well, eventually, it was fun for the first four weeks of doing the same thing over and over. But then, every one became too used to it, became a bit too boring and sometimes, we didn't really want to do it. We wanted to play a game or something but we were there to do different things. But it became too repetitive as (Name) said.
00:08:14	S1	Okay, (Name)?
00:08:17	S4	Sometimes, they did something for like four weeks and then we just get bored of it and we don't want to do it anymore. At the kind of end of it, we mostly just wanted to play a game for our warm-up but we had to do, like, jogging and sequences and all that.

00:08:36	S1	Okay, what does everybody else think? Does anybody agree or disagree? (Name)?
00:08:42	S8	I agree with (Name) because all of us really wanted to play a game like tig or tunnel tig or things like that but we had to do sequences and at the end, I thought it got a bit boring after a wee while...
00:08:58	S1	Okay, does anybody think anything else about them or anything different? Okay. So what kind of things might you like to see in future in PE? (Name)?
00:09:13	S5	We get to decide what games we get to play every week because we get gym twice a week and then they would choose someone...that could decide what we get to do for the whole time of gym on that day.
00:09:27	S1	Okay, so you would like some input?
00:09:28	S5	Yeah.
00:09:30	S1	Okay, what kind of things would you choose? (Name)?
00:09:33	S8	Dodge ball.
00:09:34	S1	Okay, (Name), you were going to say something?
00:09:36	S4	I would...I like...it's kind of football because I'm into football.
00:09:44	S1	Okay. (Name)?
00:09:44	S3	Football and chain tig.
00:09:46	S1	Chain tig, did you say? (Name)?
00:09:49	S2	I would probably say...a different kind of sports.
00:09:54	S1	Okay, so you would like to more sport things rather than different activities. And what other things would you like to see in PE? What kind of opportunities would you like? (Name)?
00:10:07	S6	Well, like now, we could be training for our sports day. We do big long runs and I quite like that. But normally, we would just do it in the gym better movers better thinkers we just jog for a wee while.
00:10:21	S1	Okay, so you would like to do more running?
00:10:23	S6	Yeah, but then after, it didn't really get really exhausting anymore when we started to do it over and over. It didn't really...
00:10:33	S1	Okay, so at the start, it was a bit tiring but then, it wasn't tiring after you've kind of gone through your block of activity? Okay. What other things might you like in PE? (Name)?
00:10:48	S7	Maybe at the very end of a session, if we've got an extra 15 minutes or so, you might be able to play like a wee game just to finish us off.
00:10:58	S1	Okay, what kind of game might you like?
00:11:05	S7	Dodge ball, stuff like that and tig and all of that.
00:11:09	S1	Okay. (Name)?
00:11:10	S4	Well, at the end of gym I'd kinda like a wee game of tag or any kind of tag to just rest you down.
00:11:10	S1	Okay, to calm you down before you go into your next lesson?
00:11:26	S4	Mm-hmm.
00:11:29	S1	Okay, is there anything else that you'd like incorporated into PE?
00:11:33	S5	Like more chances on the climbing frame because we hardly ever get that anymore like we used to. The last time we got it was last year and we all enjoyed playing on it at times.
00:11:44	S1	Okay, so is that like...inside climbing frame like gymnastics or... (Name)?

00:11:51	S8	Like on the climbing frames, we'd all get set challenges when we had Mrs (Name) or a gym teacher, we'd play a tig game with...you'd have...this was from ages ago so I don't think a lot of them will remember it. But we would climb up the bench and then go across and then your partner will tried to tig you and then the person who is behind you would be set off. And then the person will try to tig you who is behind you and that's how it works.
00:12:19	S1	Okay, it's like a kind of obstacle course but with tig as well?
00:12:19	S8	Mm-hmm.
00:12:23	S1	(Name)?
00:12:25	S2	On the climbing frame, we did...I think it was kind of a race or something like that and then I would put like the it's kinda like a ladder like for the monkey bars, I put it quite up high and I had to do the monkey bars going across and all of that.
00:12:42	S1	Okay, so you like the climbing frame and the kind of challenges that you went across then? What do you think you've learned in your lessons from the beginning of January this year? (Name)?
00:12:42	S9	All those sequences I learned those are quite cool and fun to do.
00:13:07	S1	Okay, (Name)?
00:13:12	S8	Well, I learned to do it, things slightly more challenging. And before I couldn't do two things at once when we we're like two to two, to right to two to right to two to two and doing things with our feet at the exact same time because we're going to move at the same time and with rhythm.
00:13:31	S1	Okay, so you learned the patterns with your arms and you started to learn to be able to do different things with your arms and your feet to a certain rhythm. Okay, are there other things that you've learned? (Name)?
00:13:45	S4	I've learned more stuff I can do when I've got free time to go outside and do it.
00:13:53	S1	Okay, what kind of things?
00:13:56	S4	Like go and practice running and my...what I learned in Better Movers Better Thinker and what I've learned there.
00:14:02	S1	What did you learn? What have you learned? (Overlapping Conversation)
00:14:06	S4	Like all the sequences and all that and the tennis tricks we've learned and all that, the juggling.
00:14:12	S1	Okay, what other things have you learned in the class? Can anybody else... So, some of you have mentioned different skills that you've learned. Other...any kind of different games or anything you've learned or if you learned anything about your body or yourself or other people. (Name)?
00:14:41	S9	There was a game where we were running around and then he claps and we all stop and then whoever is closes to you stop, then we do...it's like a maths thing where you clap your hands and you try and guess which number it is and then you stamp your feet. And then you'd, if it was three and four, it would be stamp four and the other person would do the same thing and add them both up and then you run again and meet up with another person.
00:15:08	S1	Okay, (Name)?
00:15:10	S3	We've done that but like days of the week. We're doing the clap sequence and doing like Monday and then another person would do Tuesday and all that.

00:15:17	S1	Okay, so that's kind of thinking about things whilst doing different activities at the same time. Anybody else? Anything else that you've learned? (Name), were you going to say something?
00:15:28	S4	No.
00:15:30	S1	No? Okay. Have you learned anything... You talked about the sequences that you learned and that they had to have different things in them, what have you learned about those? (Name)?
00:15:43	S7	Well, some people have done... What we do is we would have five minutes to practice a sequence and then we show some and then do that rest and then, show them as well. And when you see other people's sequence, you take some of the ideas and use it on your own.
00:16:02	S1	Okay, so you've started to learn off each other? That's nice. What kind of things do you do in your sequences? What...how do you decide what to put it? (Name)?
00:16:16	S8	Well, you discuss for a wee while and then they give us thinking time and then when you're ready, you'd start to think of something. Like, you do see like you go cross, cross and then do something at the same thing.
00:16:16	S1	Okay, (Name)?
00:16:38	S4	Like on the sequences on that mats...the boys always went on a mat and we've always done like a pyramid and we just try to add something to do it, make it better every week.
00:16:56	S1	Okay, so you started to kind of improve, worked together to improve your sequence each week. (Name), were you going to say something or you just...
00:17:05	S2	No.
00:17:07	S1	Okay. So you've talked about a few different things that you learned. Could you give me an example of what you were learning and how you learned it? That's quite hard to think about but you talked about being able to do things that you couldn't do at the start so you managed to learn it so how did that happen? (Name)?
00:17:37	S7	Well, the teacher would show you it and then you would repeat it again and then you would do it step by step. And then after you've done it a couple of times, you would like speed it up a bit and then slow it down a bit and then the more you have done it, the more that you improved on it and you learned it more and you're able to do it.
00:17:58	S1	Okay, so you repeated it and you were shown it. Were there any other stages or things that helped you learn a different thing? So how did the practicing work? The practice you practice each week to help you learn? (Name)? (Name)?
00:18:31	S8	Like, I wasn't really going to put my hand but...
00:18:37	S1	Okay, that's fine. So how did you feel when you were learning new skills and activities in PE? (Name)?
00:18:48	S4	I felt kind of good when I was learning new stuff to learn and do.
00:18:56	S1	Okay, so it made you feel good. (Name)?
00:19:00	S2	At the start, it was good but then, it felt good but then, when we kept doing it all over and over again, it kind of started to feel a bit boring-ish or something like that.
00:19:12	S1	Okay, so it was good when it was new, you were learning new things but then, it got boring. (Name)?

00:19:18	S8	They brought us...like we weren't getting enough time to practise, they're like, "Let's go out for a bit." And then they would bring us back in and then tell us what to do and then they do a sample of that and then it's like...we already know what to do. And then they keep talking and we didn't really get that much time to do the stuff that we were doing and we all had ideas for it.
00:19:27	S1	Okay, so you didn't get enough time to actually do things. There was too much chat from the teacher?
00:19:40	S8	Mm-hmm.
00:19:47	S1	And too much demonstration. Okay, (Name)?
00:19:50	S5	It's fun to learn new thing but when they kept talking and we were doing alright, they just kept talking, really. And then we get less time to play and doing what they're asking us to do.
00:19:50	S1	Okay. How did other people feel about it?
00:20:06	S6	I don't think a lot of us enjoyed it and we had to keep being brought in when we were in the middle of a sequence, when we were thinking things out. And then, after that, it just got really repetitive and not a lot of us really enjoyed it after that.
00:20:11	S1	Okay, (Name)?
00:20:25	S5	Well, we all speak to each other. Sometimes, we ask if we are like doing the gym. But at first, everyone liked doing it and then we kept asking him and then they were all saying it was just getting too boring doing the exact same things almost every week.
00:20:41	S1	Okay. Does anybody disagree or agree? Do people agree with it being boring? Few nods (Name)?
00:20:52	S4	I agree.
00:20:52	S1	You agree. So how did you feel when you were learning the new things? (Name)?
00:21:01	S2	It felt like...as if you've already done it before but you haven't. As if you've done something same as that.
00:21:01	S1	Okay, so you kind of recognised it. How did other people feel with the new things? (Name)?
00:21:24	S7	Well, some of us quite enjoyed it. We would all enjoy it at the start when you would go around in circles and then until you got in and out of spaces, everybody used to go in a big circle and then we'd end up in those spaces but after a while, we kept doing that and doing it, it kind of got a bit boring at the start a wee bit. And then we'd get brought on to a new topic in it like, let's say, tennis was one, you would do that for about three or four weeks and then you'd move on to another topic….but it's okay, it's good.
00:22:00	S1	Okay, so...was three or four weeks long enough or too long or... (Overlapping Conversation) So, three or four weeks is too long on one thing because...
00:22:09	S6	So, if we did it for about two weeks, it would be okay because when we get the basics and then the next week, we could play a game of it.
00:22:19	S1	Okay, so you'd like...and you didn't get to play any games?
00:22:24	S6	No, because all we do is they would...sometimes, there was two teachers and when we were doing tennis, they would just play and wouldn't let us have a go.
00:22:35	S1	Okay, so sometimes, the teachers played and didn't let you play? Okay, (Name).

00:22:41	S3	See how the tennis, we could have had a big giant tennis match, like half of the class versus the other half because we were practicing all the stuff for tennis and then we didn't get the chance to test it.
00:22:52	S1	Okay, so you felt like they were teaching you all the skills but then not letting you move forward and play and...how do you feel about competition and playing against each other? (Name)?
00:23:06	S7	A lot of people in our class is very competitive and everybody likes a good competition. Let's say, one time we had, we don't get into pairs and partner up and we would have two partners and then another two partners....and the big tennis...what do you call it? Like court net, like tennis net would be out and we'd do a pair against a pair. It would be quite funny because some of us would hit the ball way out of the box and so, it would be quite good but everybody was really competitive at they certain bits.
00:23:45	S1	Okay, is that a good thing or a bad thing or...
00:23:45	S6	It's a funny thing.
00:23:51	S1	It's funny? Okay. Well, that was in a diff-...that was before the beginning of this year, that match across the big tennis thing? That was a different time. Okay, (Name).
00:24:01	S2	I would see, like, see when we were doing the thing in the tennis like two on two. Some groups, **then,** three. And I wouldn't say that the teachers were pure bossy if we ever messed up or something. But it they were kind of like pure, well not like pure shouting at us but they were kind of shouting at us because it was me, (Name), (Name), (Name) and (Name). And we were doing one and because we don't know which one would go first or something like that, they came and started showing that us.
00:24:33	S1	Okay was that in this...since January or is that another time?
00:24:38	S2	And that was January
00:24:39	S7	When we had better movers and thinkers
00:24:41	S1	Okay, so, if you didn't know what you were doing, you felt you'd got into trouble if you got it wrong, is that right?
00:24:47	S4	Yeah.
00:24:47	S1	Okay, Just checking. (Name).
00:24:50	S4	It's when we were standing up at the centre of the big thing and this was when we were doing better movers, better thinkers in tennis. And then, he said to us, "Go down there." But then it looked like he was pointing at the space right there. Then, we stayed there, and then he kinda shouted at us to go down to the bottom but there were no spaces
00:25:07	S1	Okay, so sometimes, instructions were confusing?
00:25:21	S4	Mm-hmm.
00:25:23	S1	Okay, (Name).
00:25:25	S8	Well, as (Name) said, there's competitive people, I'm one of those competitive people but it's really fun. Like when we got better movers, better thinkers, we weren't really allowed to compete against each other and if we went, "You're going down," as in in a kind of sarcastic way, they say it is not a competition, it's just to practice or something.
00:25:25	S1	And how did that make you feel?
00:25:51	S8	Well, that made it a bit boring.
00:25:51	S1	Okay. (Name)?

00:25:55	S5	Well, sometimes when we're having fun, we're all having a laugh and that. They would make us...sometimes, well, they wouldn't really shout but they would moan and then they would try and make us stop having as much, carrying on a wee bit It wasn't like, "Well, carry one, we were just having a laugh." But then, they will make us go straight back to what we were doing. But less fun when we started doing it.
00:26:22	S1	Okay, so, you felt that when you started to go a bit off-task and they kind of brought you back and that was less fun?
00:26:31	S5	Yeah.
00:26:32	S1	Because they were trying to stop you having a laugh with your friends. Okay. What else do you think about the way you learned? Do you think PE, the way you learned in PE, in the better movers and thinkers, is that similar or different to how you learned in other lessons? (Name)?
00:26:53	S8	It's much different because normally, say, if we would...I don't know, whatever we play, like a game at the beginning and then we'd do a stretch and then if we carried on a wee bit, the teacher would shout at us and say, "Stop talking, get back to your..." Well, better movers and better thinkers didn't really shout at us but they moaned like (Name) said. And then, when we had a laugh like at our old gym, or the gym we're doing now, the teacher would just...not encourage it but let it go. But like when you had a laugh or carried on a wee bit and went off task. I think, a wee bit...the people in better movers, better thinkers would just moan at us and say we have to get back to that task.
00:27:56	S1	Okay, so how is it, (Name)?
00:27:56	S2	See cause we were saying they were moaning and that, it was because we had three teachers for better movers, better thinkers. It was only two of them that was doing it but the other one was (Name), he was fine. He was nice but the other two are kind of like moaning at us and all that.
00:28:19	S8	Mr. (Name) was the one that talked the most.
00:28:20	S3	Yeah, he had fun with us but you all have to just couldn't have that.
00:28:25	S8	We like Mr. (Name) but he was the one that brought us back more, like when we were in the middle of like a routine, he was the one that talked to us most of the time. Instead of letting us get on with our sequences that we were already doing.
00:28:47	S1	Okay, (Name)?
00:28:52	S4	Well, the two teachers would say, "Get on with it" But (Name) would let you have a little bit of laugh and giggle." But they all want to...would just say, I wouldn't say they would say, "Just stop that." They would say...
00:29:08	S8	"Get back to your task."
00:29:10	S4	"Get back to your task."
00:29:11	S1	Okay, so how is learning in PE different from the other lessons that you might do in class? (Name)?
00:29:22	S2	Because you learn a different kind of...because you're learning about different things.
00:29:26	S1	Okay, so can you expand on that a little bit?
00:29:26	S2	Well, like if you learn about PE and movement and all of that, in class, you're sitting down, you're learning about language and maths and all that so it's different.
00:29:30	S1	Okay, (Name)?

00:29:41	S7	Sometimes, if you do, let's say, maths, Ms. (Name) would put in a clap sequence with it just to kind make it fun and I would kind of like relate to better movers, better thinkers because the same things are going on but then, it's good because we get to play a wee game before maths and then we would get in like our clap sequences or we'd do a clap...like a wee pattern or something. It would be quite good.
00:30:11	S1	Okay, so that is something that is quite similar. How would you think that helped? Do you think that helped in maths or is it just fun?
00:30:18	S9	I think it sort of helped you remember your tables because if you've done the times tables, let's say, the square, cross, cross, square, you would remember like eight nothings are nothing, square, cross, cross, square would help you remember the number and the tables.
00:30:18	S1	Okay, so you felt it helps you learn. (Name)?
00:30:32	S8	Well, square, cross, cross, square, also is kind of really confusing and it helps you concentrate more because you're not looking at your friends laughing you'd be like this, try to concentrate, keep you in the rhythm. And if you missed one, you will just go all over the place. And you also have to...it was really hard and the teacher found it quite difficult at as well.
00:31:02	S1	Okay, so you got to concentrate?
00:31:04	S8	Mm-hmm.
00:31:04	S1	Okay. And what did you think that teacher found it...about the fact that your teacher found it quite hard?
00:31:04	S8	It's because she wasn't really...she kept (Laughter) because normally, it's because probably she wasn't learning it with us. I don't think she's as good as the...as us.
00:31:27	S1	Okay, so you're better at it? Okay. (Name)?
00:31:30	S7	It's funny because if the teacher messes up, we mess up then we have to start all over again.
00:31:30	S1	Okay, (Name)?
00:31:36	S5	I think it's because we were used to doing the multitasking and the gym but Miss (Name) used to just watch but sometimes, she would join in. But then, when we're doing maths, it's full on multi-tasking because you're saying your times tables and doing the patterns at the same time.
00:31:51	S1	Okay, so do you think to be able to master how to do the multitasking, do you think you have to do it rather than watching? Because you said your teacher watched but then you were actually doing it. (Name)?
00:32:06	S2	I don't think what this means...it's like it seemed when you are doing the multi-tasking and the class that you were doing it, like speaking and doing at the same time. But at the end of January, you were only doing that, you weren't actually saying anything.
00:32:20	S1	Okay, so it's harder? So you'd need to...it takes more concentration. How do you think it's different? Is learning in PE different in any other ways to learning in your normal lessons? (Name).
00:32:36	S8	Well, yes, because in our lessons, normally...well, it's kind of the same but...say, the work that we do in maths, it's like when we're writing it down, it's kind of like the work that we do in gym when we're doing our gymnastics and things. And then, when the teacher does talk to us about the TJ books it's like when (Name) was talking to us about the gym, and then when we were doing the clap patterns, it's like when we're practising our table and doing our maths games and then warming up, it's like...and our

		jog is like warming up for our maths game. Well, not warming up like our maths games...are warming up to do the TJ to get your revision and that's what I think the running and the jogging and the sequences were all about, to repeat them just for revision.
00:33:25	S1	Okay, (Name)?
00:33:31	S2	Well, I also think that our gym is funnier because a couple of weeks ago, because we are topic is the commonwealth games, we'd done the miracle mile but we actually did two and a half mile nearly.
00:33:44	S8	Because (Overlapping Conversation) that really...because our playground's quite big and we had to do it that way and the teachers said we have to do that seven times and it's actually three laps (Overlapping Conversation) miles. So we did two miles and one lap.
00:34:01	S1	Wow. So that was in your normal class or was that in PE?
00:34:06	S7	It wasn't in PE.
00:34:09	S8	It was like problem solving because we were watching this video in Expressive so it's like saying that people could run, a child can run a mile in 10 minutes. And then, the average boy can run a mile in about eight, I think it was. So that was our problem solving just to prove that the expressive movie was true.
00:34:28	S1	Okay, so to see if you could walk a mile and how long it took you to walk it but you ended up walking a bit too far?
00:34:33	S8	No, we ran it.
00:34:34	S1	You all ran it, okay. And what did...what happened? What were your times? Or do you not (Overlapping Conversation)
00:34:34	S8	Well, mine was 20 minutes because we'd done it for two miles. The fastest boy, I think, is (Name). He got 16 minutes. And the fastest girl was (Name), she got 19, I think.
00:34:55	S1	Okay, so you all timed each other to see if...
00:34:58	S8	Well, the people that forgot their PE kits timed us.
00:34:58	S1	Okay. (Name)?
00:35:03	S2	But it was kind of like gym as well because we were using up our gym time plus it was like exercising as well so it was practically gym but it came from problem solving at the same time.
00:35:14	S1	Okay, so that's lessons merged together, (Name)?
00:35:17	S7	When we'd done the problem solving before the miracle mile and we can now...we estimated how long we thought we would have been and if we would have been able to complete the mile but we were...a lot of us were a way off and most of us completed it in 25 minutes and 23 minutes. But it was a bit of a bonus at the end because we all got choc ices.
00:35:45	S1	(Laughter) nice. (Name)?
00:35:45	S8	Like in better movers, better thinkers, if you forget your gym kit, you just kind of join in but in our gym, normally, we go outside and if we don't, the teachers tell you to take your shoes off and we're allowed to join in on our gym. But that was the bad thing about better movers, better thinkers because every week, at least some one has forgot their gym kit. So it was a bit unfair for the people who had to sit at the sides and not join and just watch.
00:36:15	S1	Okay, so there wasn't any alternative for if you forgot your kit? Okay. Are there any...is there anything that...you mentioned a few things that are...in the way that it's similar or different to other PE classes and other lessons

		like problem solving and things that you do in your class. Is there anything else in that it's similar or different to? So how is it similar to the way you get taught in your classroom in there? (Name)?
00:36:48	S7	Our teacher would usually put in some of the sequences from better movers, better thinkers and she would just do that and would, "Oh, can I do the sequences? We'll...like multitasking." And she'd put in like square, cross, cross, square, she would do all that and then sometimes, she would put in a new sequence and forget them, but it was quite fun.
00:36:48	S1	Okay. And have you used multitasking in other situations, do you think?
00:37:22	S3	We just mainly did it in maths. And on our PE with Ms. (Name) but apart from that, no, we never did it, really.
00:37:23	S8	With better movers, better thinkers, we do in in a clap sequence and we get a topic and we...since we did Italian he would say we have to count up to 10 like [inaudible 00:37:42] were doing and [inaudible 00:37:47].
00:37:48	S1	Okay, so they brought in kind of things that you were learning in class? How do you think that learning in PE affected your learning when you went back to class? Do you think it changes or do you think it's different or is it just the same? (Name)?
00:37:48	S8	Because now, we can multi-task. Before, when we try to multi-task, I sucked horribly at it. But now, when I try to do it, I'm better because I've had practice and before that, I never really attempted to do times tables and clapping at the same time and then I can do it.
00:38:26	S1	Okay, (Name)?
00:38:26	S7	Better movers, better thinkers helped us...we can improve on multi-tasking but some of the things they taught as well, we already knew how to do really well. And they taught us...we could multi-task but we weren't really good at it. But we could do all that stuff we did and would tell us...they would put in, they would throw in some maths in it as well so it's like...just like a lot of multitasking.
00:39:02	S1	Okay, (Name), you were going to say something? No? Okay. So is there anything else that you'd like to say about PE or the better movers and thinkers? (Name)? Were you just moving your hair? Sorry.
00:39:18	S8	I'm just going like that (Overlapping Conversation)
00:39:20	S1	Okay. So is there anything at all you'd like to say about it, feel free whilst it's getting...we're chatting about it. (Name)?
00:39:20	S8	Well, like, if you were meant to improve with better movers and better thinkers, we never got a game. So, I think, at the end or at the beginning a warm up game and like an ending game. And then also, not to bring us in so much as in to talk to us because we already knew what we were doing or to ask us on our opinion were? Like if we wanted to change it or what game we wanted to play, what we really wanted to do.
00:40:00	S1	Okay, (Name). Sorry.
00:40:01	S7	Well, one of our teachers that we get in schools says it's okay to make mistakes and sometimes, in better movers, better thinkers, they make you do it perfectly even if you're getting it taught for like four or three weeks at a time.
00:40:17	S1	Okay, so another class...you were told it's okay to make a mistake but then, in better movers and thinkers, you've got to do everything perfectly?
00:40:25	S8	Yeah, because they said you have to perfect it, like point your toes.
00:40:28	S1	Okay, how did that make you feel?

00:40:30	S8	A bit annoyed.
00:40:33	S1	Anybody else? Okay, (Name).
00:40:38	S5	This is really jazzed up a bit that they changed it. Say, if they were to come back and then it would change things a bit because to us it was just too repetitive and everything was just the same. And if we don't know if we…it's like, if they were going to do something different with us the next time, we were all trying to get to do something, so we're all just like...the boys went...because we usually just get changed first and we'd be ready and the teacher would talk to us and we would usually ask if we'd go down to the pitches if it was sunny or to play a different warm-up, a game but they usually answered no but...we only got to go on the pitch for two things, was it?
00:41:27	S3	Okay. I remember once when the boys went in the gym hall us and the teacherwould sit and be talking about football, like teams and that...
00:41:37	S1	Okay, so you were just chatting before PE about football but then, you weren't allowed to chat about that (Name)?
00:41:45	S2	We would sometimes...I forgot what I was going to say...
00:41:52	S1	Okay. So, anything else, really, about better movers and better thinkers or just about PE? So it got quite boring? You said you liked, at the start, you liked learning new things but then, it was just too repetitive and you wanted to play more game? Anything else, (Name)?
00:41:52	S7	I enjoyed better movers, better thinkers but if they were to come back, I think they should do two weeks for one topic. So, one week, we could practise everything. The next week, we can show it to the class.
00:42:13	S1	Okay, (Name)?
00:42:29	S8	If they were to come back, they should actually ask us what our opinion, what we think. And if we wanted to play what game, if they were going to play a game.
00:42:42	S1	Okay, (Name).
00:42:43	S3	See on the last day of better movers, better thinkers, I think we should play the game because we had to do all the work for the months and that.
00:42:51	S1	So you had to show all your parents what you'd learned?
00:42:57	S3	No, we had to do all the stuff in gym and didn't get to play a game, so I think we should have played on the last day so we could have a little bit of fun at the end.
00:43:08	S1	I see. So you could have some fun rather than just doing all the things you'd rather be doing. (Name)?
00:43:13	S2	I think, what (Name) is saying is like at the last day, we had to do everything that we'd already done, from the very beginning. I think that's what it is.
00:43:28	S1	So you had to repeat all the stuff you learned from day one.
00:43:32	S3	And we couldn't get any of the time to play a game on the last day.
00:43:36	S1	Okay, and you'd rather...played a game or something. Okay. I'm just going to finish it up later. Thank you very much for your time and I'll turn the tape recorder off.

APPENDIX B –
Intervention school 2 focus group transcription

Intervention School 2: Focus Group Interview

Duration 35 minutes 30 seconds

Speaker key

S1 Speaker One (Facilitator)
S2 Speaker Two
S3 Speaker Three
S4 Speaker Four
S5 Speaker Five
S6 Speaker Six
S7 Speaker Seven

Timecode	Speaker	Transcript
00:00:00	S1	Okay. So, that's both the… the recording is on just now. Okay. So, just to start off so that I can get to know all your names. And so that we get used to speaking on the recording. Can we go around in a circle? And can you say your name? And can you say what your favourite flavour of ice cream is, please? So, my name is Chloe. And my favourite flavour of ice cream is cherry. Okay. Let's go this way.
00:00:32	S2	My name is (Name). And my favourite flavour of ice cream is chocolate.
00:00:36	S1	Okay.
00:00:38	S3	And my name is (Name). And my favourite flavour of ice cream is chocolate.
00:00:42	S4	My name is (Name). And my favourite flavour of ice cream is bubble gum.
00:00:48	S5	My name is (Name). And my favourite flavour of ice cream is bubble gum.
00:00:53	S6	Hi. My name is (Name). And my favourite type of ice cream is Scottish tablet.
00:01:00	S2	My name is (Name). And my favourite is chocolate.
00:01:02	S1	Okay. Lovely. So, just to start off with. If we can all face the middle so that the microphone will pick us all up. Can you tell me a little bit about what you've been doing in PE since January? So, since after Christmas. What activities have you been doing in PE?
00:01:22	S6	We've done a couple of weeks of gymnastics.
00:01:25	S1	Okay. Anything else.
00:01:28	S5	Better Movers and Thinkers.
00:01:30	S1	Okay. So, what's involved in Better Movers and Thinkers? What do you do in that?
00:01:33	S3	Clap patterns and sequences, accents
00:01:38	S1	What was that (Name)?
00:01:38	S5	Accents
00:01:39	S1	What's that?
00:01:41	S5	It's like when you're running like and maybe on the third step you just lift your knee up a little bit higher. And then, going off for another three and then lift the other leg higher. And just keep going on.
00:01:51	S7	Then, we've also done mat sequences at the end.
00:01:55	S1	Maths?

00:01:57	S3	No mats. We did maths as well, like with clap patterns. We did juggling as well.
00:02:03	S2	Oh, done juggling. Yeah.
00:02:03	S1	You do juggling as well. Do you, (Name)? Try and speak one at a time. Okay. So, (Name) you did tennis. Yeah. Okay. And what were the sequences on the mats that you did?
00:02:13	S7	We got to make them up ourselves.
00:02:16	S1	Okay (Name)?
00:02:17	S2	You'd go with a partner and make up a sequence then do it.
00:02:22	S3	It had to involve flight, balance, travel and rotation.
00:02:30	S2	And rotation. (Overlapping Conversation)
00:02:33	S1	What did you say there (Name)? Agility. Okay. And so what are these things that you had to include? What's flight?
00:02:41	S3	It's where you got to somehow….both of you have to be...you and your partner have to be off the ground.
00:02:47	S5	You could do it with more than partners. Like at one point I think there was a group of four…
00:02:51	S2	Four, one, two (Overlapping Conversation).
00:02:55	S5	Five or six.
00:02:57	S1	Okay. What else do you need to include in the sequences?
00:03:02	S4	Travel. So, you had to get from one end of the mat to the other.
00:03:06	S1	Okay. Does it matter? Did you do that in different ways or...?
00:03:10	S6	Yeah, you weren't allowed to slide across the mat or like run. You had to maybe hop or maybe like do a cartwheel or something or anything (Overlapping Conversation).
00:03:20	S1	Okay. And what else did you need to include...was there anything else that was involved in the sequences?
00:03:26	S3	Balance.
00:03:27	S1	Okay. What was the balance about you mentioned?
00:03:30	S7	Just like you have to…like do any balance you wanted and do it with a partner or not.
00:03:37	S1	Okay. So, is there anything else you did since January?
00:03:41	S6	Gymnastics. And then, we started on athletics, a block.
00:03:47	S1	Okay. (Name).
00:03:48	S5	We've done like…in athletics, we've doing like shuttle runs and…
00:03:53	S7	Jumping over hurdles.
00:03:54	S5	Jumping over hurdles and like timing each other.
00:03:56	S6	We're also doing what's that other thing called? Side runs.
00:04:01	S1	You're doing Shuttle runs.
00:04:02	S5	This week. Yes, I think on Monday we had like a parkour thing. It's like a big course. Then, you had to go to the meadow garden and jump over trees and do a long jump. And like go over the jump trail and stuff.
00:04:17	S1	Okay. Great. Anything else at all that you can think of?
00:04:21	S3	Gymnastics, that was fun.
00:04:22	S1	Okay. What did you do in gymnastics?
00:04:25	S3	You done like...

00:04:27	S1	(Name).
00:04:28	S2	We bring like the big apparatus out from the wall.
00:04:33	S1	Okay. And you just do different activities on it?
00:04:37	S2	Yeah. You basically climb, go down poles.
00:04:39	S3	And then, there's three ropes that dangle and if you want, you can try swinging on them. Or else you can try climbing. Most people swing on them.
00:04:49	S1	Okay. (Name).
00:04:49	S5	And then, we had like different things set up so that you would go to one task and move onto the other. And one of them was like you ran, jumped on the spring board and then went up to the horse, then do a roly poly or you just walk over and do like a straight jump, a star jump and land on the mat.
00:05:07	S1	Okay.
00:05:08	S3	We done micro fitness. That wasn't like gym but that was an activity that was like a proper gym. (Overlapping Conversation).
00:05:19	S1	So, was this in...
00:05:21	S3	Zumba and stuff as extra.
00:05:22	S1	In school or was this after school?
00:05:24	S3	In school.
00:05:25	S2	And we've also done body attack.
00:05:29	S1	Okay. So, this was just kind of a special week where you did different healthy things. Okay.
00:05:35	S4	The micro fitness, there was different equipment, like gym equipment.
00:05:39	S3	Oh, gym equipment.
00:05:40	S1	Okay.
00:05:41	S4	And you got...you went around...you were in a group of two or three and you went around and you had a shot of every one. And there was this bouncy castle bit and you had to stand at the bottom of it, and try and get as many balls into the hoop as you could.
00:05:58	S3	And we used to do...we also had netball.
00:06:00	S1	Okay. Netball also.
00:06:01	S3	This week, we're doing stuff like that that's why we're in PE kit. Boxercise, sports day…
00:06:09	S6	Gymnastics.
00:06:11	S4	We've got gymnastics, boxercise, weight lifting.
00:06:13	S5	Badminton.
00:06:15	S1	Badminton as well.
00:06:15	S3	Rugby. No we don't wait yeah we do. We're doing rugby outside.
00:06:19	S1	Okay.
00:06:20	S3	And then we're also doing afterschool clubs like gymnastics.
00:06:25	S4	But everyone's got the chance to.
00:06:30	S1	Okay. So, what do you think about these different activities?
00:06:33	S3	Better Movers and Thinkers was quite repetitive.
00:06:36	S2	It got a bit annoying sometimes.
00:06:39	S4	At the start, you always went in and started jogging around the hall for about five, 10 minutes.

00:06:43	S6	Then you do like sequences. And you knew what was going to happen.
00:06:48	S1	Okay.
00:06:50	S6	You kept doing it over and over.
00:06:51	S7	People in our class have been saying that their favourite thing was where the juggling and the mat sequence. And someone said that was like the only things that weren't repetitive.
00:07:02	S1	Okay. Anything else? What does anybody else think about it? (Name).
00:07:09	S5	It got you like thinking more because you had to do like do multi-tasking.
00:07:15	S1	Okay. So, like what kind of things?
00:07:17	S5	When we had to juggle and like you had to walk and juggle at the same time. Or if you can do that, jog and juggle or something. And you had to like, when you juggle and you need to somehow manage to swap the juggling balls with your partner or something. It was really cool how people done that as well.
00:07:41	S1	Okay.
00:07:42	S6	And then we got taught how to cradle the ball with the tennis racquet. You had to get, you had to throw the ball up in the air and then you kinda went like that and you scooped it round when it came down like that.
00:07:56	S2	I did it.
00:07:57	S1	Okay. So, what do you think of the things that are difficult like this activity?
00:08:05	S6	They're fun.
00:08:06	S7	They're challenging.
00:08:07	S6	Because you have to keep on doing it until you get it right so it was really fun.
00:08:12	S1	Okay. What does everybody else think?
00:08:15	S2	Challenging.
00:08:16	S1	Okay. Is that a good thing or is that a bad thing?
00:08:18	S2	It's a good thing.
00:08:19	S4	It's a good thing.
00:08:21	S1	Okay. And what else did you think about the things that you did in PE?
00:08:27	S3	The mat sequences ones was the gymnastics before Better Movers and Thinkers. And then what we're doing just now because we get to split up in teams.
00:08:36	S6	Like we try and beat our personal best.
00:08:39	S3	It gets quite competitive sometimes.
00:08:41	S6	Yes.
00:08:42	S1	Okay. And how do you feel about if it's competitive?
00:08:45	S6	That's fun. (Overlapping Conversation).
00:08:46	S1	Okay. And who are you competing against?
00:08:49	S4	Each other.
00:08:51	S5	Yourself sometimes. You get put into groups. And then, you have to do like the races and stuff.
00:08:56	S6	It's like normally four groups or three groups of about six or seven.
00:09:01	S1	Okay. (Name).

00:09:03	S5	You can sometimes compete by yourself like beating your personal best. That's what people were doing. Like you had to time it, say I got 13 seconds in one shuttle run, I might try and get 12 or 11 seconds on my next.
00:09:15	S1	Okay. What other things...what else do you think about the different activities?
00:09:27	S6	Gymnastics is sometimes quite hard. Most people found it hard but I don't really because I go to it. Like if you don't it's really hard because I couldn't do half the stuff before.
00:09:41	S1	Okay. So, if something's quite difficult, how does that make you feel?
00:09:45	S6	It's fun because then you keep on trying and when you get it, it's really good.
00:09:48	S1	Okay. Anybody else thinking any different? Does anybody not enjoy things if they're quite hard?
00:09:58	S2	Sometimes.
00:09:58	S1	Okay. Why? What would happen if…in that kind of situation?
00:10:02	S7	Frustrated.
00:10:02	S1	Okay. So, you get frustrated. Anything else?
00:10:07	S2	Like you just keep on trying to do it.
00:10:10	S1	You just keep trying. Okay. What about if things are easy? How does that make you feel?
00:10:16	S7	That's great. That's a great feeling that you can do that, that sort of thing.
00:10:18	S1	Okay. So, sometimes it's better. Okay, (Name).
00:10:22	S5	Yeah. If it's a bit too easy then I might ask the instructor or coach to maybe give you something a bit more challenging.
00:10:29	S1	Okay. And would you do something like that if it was too difficult as well or is that an option or not? If something was...So, (Name) said if it's too easy you might ask if you can get an alternative to make it a bit harder. Would you be able to do that if it was too difficult?
00:10:48	S5	You keep on trying until you got it.
00:10:50	S1	Okay. So, you said sometimes if it's easy, it can be a bit boring. Some of you also said. It might be quite good but it could also be boring. Okay. And what about Better Movers and Thinkers. What was that like in terms of easy or hard? (Name)?
00:11:11	S2	Well, I enjoyed the Swedish long ball we were doing. After it started to repeat a lot and we would always go on and do running. Eventually, we got to do a game called Swedish long ball.
00:11:27	S1	Okay. And what does that involve?
00:11:31	S2	A ball. People.
00:11:35	S1	What do you have to do in the game?
00:11:38	S5	Got into two teams.
00:11:40	S2	Two teams and then...
00:11:41	S4	A team punted the ball up and they had to run across. And the other team are only allowed in a box in the middle. And they've got...one of the people from the team in the middle, they have to run out, get the ball, run back into the box, and try and hit someone before they get to the other side of the hall.
00:12:01	S1	Okay. So, you enjoyed the Swedish Long ball. Okay. (Name), you were going to say something?
00:12:10	S3	They've got...it was hard at the beginning of the Better Movers and Thinkers, but because we kept doing it over and over again. Then it got quite easy.

00:12:21	S2	Easy because we kept doing it.
00:12:22	S1	Okay. So, you practised each week and it got easier. Okay. How did you feel about it getting easier?
00:12:33	S6	Quite bored.
00:12:34	S3	Because we kept on doing the same thing over and over again and you wanted to do something different.
00:12:40	S1	Okay.
00:12:41	S5	I think that's why people like the mats so much because you got to like do something different, it was your own, it wasn't like you were getting told.
00:12:49	S1	Okay. So, do you prefer having kind of an input into different things? And does the change make it more interesting? How does...what kind of things did you do that you had control over that you could change?
00:13:07	S7	Like what you wanted to do on the mats.
00:13:09	S5	Or you could change anything you wanted as long as your group so, even if you didn't like something then, you could change it.
00:13:17	S1	Okay. What kind of things would you like to see in future PE classes?
00:13:23	S6	More gymnastics.
00:13:25	S1	More gymnastics.
00:13:26	S4	Or swimming.
00:13:27	S1	Swimming. Okay.
00:13:27	S4	Definitely swimming.
00:13:28	S1	(Name).
00:13:29	S5	Maybe a bit more rugby.
00:13:31	S1	Rugby. Okay.
00:13:32	S5	I've never done rugby.
00:13:33	S1	What kind of rugby that you do?
00:13:36	S5	Like learning how to like pass the ball, tackle and shooting.
00:13:42	S1	Okay. (Name).
00:13:44	S2	I'd like to do more football. Because we don't get much of that during school.
00:13:50	S1	Okay. Do you do that outside of school?
00:13:51	S3	Yeah.
00:13:52	S2	And at play time we go on the pitch and do it.
00:13:55	S1	Okay.
00:13:55	S6	We should also get…taught how to play football. Because when you're doing football learning it at school, they don't teach you properly. They just expect you to know all the rules and stuff. And some of the girls don't know.
00:14:11	S7	And they just like split you into teams.
00:14:15	S6	And they expect you to know what to do. They only tell us to kick the ball and to stand in the goals. Then, they start shouting, like you're doing it wrong. But they've not explained it to us.
00:14:27	S1	Okay. So, you'd like to be taught the skills and the rules of how to play. (Name).
00:14:36	S4	I'd like to get more basketball and football.
00:14:40	S1	(Name).

00:14:42	S3	Basketball.
00:14:43	S1	(Name)
00:14:45	S5	We had a person come in called (Name). And he used to be a footballer (Overlapping Conversation).
00:14:51	S6	It was really good. It was football.
00:14:54	S5	Like he done this game with us. And like there were two teams, so, it was like the boys against the girls. And there was just the goal, and if you kicked the ball into the goal it was like...
00:15:05	S4	You got a point. And you got 20 if you hit a shot and the ball was still in when it fell over.
00:15:13	S7	And that was really good because he explained what you were doing. It was fun. It wasn't like when people come and teach you how to play football. I think that was all better. Yeah.
00:15:24	S1	Okay. So, what do other people think of that?
00:15:27	S4	Good.
00:15:27	S5	It was really fun. We all liked it because we were all shouting at each other, "We're going to win."
00:15:32	S6	That was good, competitive.
00:15:38	S1	Okay. Is there anything else you'd like to see in the future classes?
00:15:45	S5	I think there should be more swimming, gymnastics and dance.
00:15:49	S6	Horse-riding.
00:15:50	S1	Horse-riding. Okay.
00:15:51	S3	That would be interesting.
00:15:53	S1	Running. Okay, you'd like to do a bit more running.
00:15:54	S3	Racing.
00:15:56	S1	What was that, sorry, (Name)?
00:15:58	S1	Oh, (Name). Was it (Name)?
00:16:00	S3	Racing.
00:16:00	S1	Racing. Like running races?
00:16:03	S3	Yeah.
00:16:05	S1	Okay.
00:16:06	S3	Because when we go to like...what is called? Cross country. We're not prepared but lots of other schools, do training during the schools. But we only like…I think by the time we actually got to train was two times around the playground. But that isn't enough. Because you didn't get the mud and stuff.
00:16:25	S6	And it's wet.
00:16:29	S1	So, you're wearing (Overlapping Conversation). Sorry.
00:16:33	S2	People lost their shoes and socks during cross country. And then, they'd be running in their bare feet trying to get them.
00:16:40	S1	(Name).
00:16:42	S4	Sometimes, when if you go to the school football team, you don't get time to see how the other people, when the team plays. So, you don't know what you should do and how to get them involved.
00:16:57	S2	Okay. So, you'd like more chance to…with your teams. So...

00:17:02	S3	If we have like a football team for the boys. And the girls that like football. I think we should have them more times.
00:17:11	S7	The girls who like football can go to a team.
00:17:14	S3	That I like I think they should have other competitions for like other...I mean, they have swimming, but that's like a swimming club thing, but that's during the school hours.
00:17:25	S1	Okay. So, you'd like more chance for the clubs out of school to have sport teams.
00:17:31	S3	Yeah swimming club I'm in.
00:17:36	S1	Okay. What kind of things did you learn in your PE lessons from January?
00:17:43	S3	What do you mean? Like Better Movers and Thinkers?
00:17:45	S1	Yes. What kind of things did you learn about?
00:17:52	S3	We haven't really learned much, we just learned to do stuff. Well, to juggle, that's all.
00:17:58	S1	Okay. So different movements.
00:18:00	S2	There were different people doing it, not just the one person.
00:18:03	S4	There were three.
00:18:04	S2	Mr (Name), Mr (Name)
00:18:06	S6	Mr (Name).
00:18:10	S1	Okay. So, there were three different teachers.
00:18:11	S6	We got Mr (Name) the most. And then, Mr (Name)
00:18:17	S3	And Mr (Name) hardly ever came.
00:18:19	S1	Okay. And what kind of things did you learn then? (Name)?
00:18:26	S5	I learned that our teacher can juggle.
00:18:28	S1	You learned that your teacher can juggle. Okay. So, you learned about other people. (Name).
00:18:32	S4	You didn't really learn that much that you couldn't do already. It was basically just running about doing movements that you knew.
00:18:41	S7	And you didn't learn like skills that could help you in general life.
00:18:45	S1	Okay.
00:18:46	S6	Because maths but...
00:18:47	S4	That was what just 1 plus 1.
00:18:51	S6	That was just kind of not so
00:18:53	S4	That was like 40 or 50. [inaudible 00:18:56].
00:18:56	S1	Okay. So, you felt that you could do some of these things already.
00:19:01	S6	Yeah.
00:19:04	S1	Was there anything...can you think of anything that you learned? (Name), were you going to say something? (Name).
00:19:15	S2	I learnt how to hold a handstand for about five seconds.
00:19:20	S1	Okay. So, you improved. Could you do a hand stand before? Yeah. But you managed to do it for longer. Okay.
00:19:28	S2	That's when we were on the mats.
00:19:29	S1	Okay. That was done in sequences?
00:19:30	S2	Trying to do it, and then, Mr (Name) told me how to hold it for longer.

00:19:39	S1	Okay. And some of you mentioned how some of the things were quite difficult at the start, but then, they got easier. So, what did you learn that made them easier?
00:19:47	S4	You just kept on doing it every week, and it just kept on getting easier and easier because you knew what you were doing.
00:19:52	S7	It was still really boring. We were improving because when you knew what you were doing, you still had to do it.
00:19:57	S1	Okay. (Name).
00:19:59	S5	Oh, like we were practising every week to make something to get a bit easier. Because then, we'll like know how to do it. But at the start, we didn't know how to do some of the things. But then as we practised and kept going every week, we would know.
00:20:12	S1	Okay. So, what kind of things didn't you know how to do at the start that you could do at the end?
00:20:18	S2	Juggling.
00:20:18	S1	Juggling. Okay. How did you learn juggling? What did you do?
00:20:25	S2	They just showed us and told us to keep the eye on the ball.
00:20:28	S1	Okay. So, you had some people showed...was that the teacher that showed you how to do it?
00:20:32	S3	Yeah. The teacher that came in but...
00:20:35	S2	And then that was it really (Overlapping Conversation). He took us over to one mat. And then, they'd show you what they were doing for ideas.
00:20:51	S1	Okay. So, you learn off other pupils. Okay. And I think (Name), you said that they gave you tips, kind of told you what to do to make it better. Is there anything else that they kind of helped you to get different skills?
00:21:11	S7	They didn't really shout at you in that.
00:21:14	S1	Okay. So, they didn't shout at you.
00:21:15	S7	Like well, sometimes...like one day people in class were talking with P5s in the class. But he doesn't start shouting at them. He just spoke to them.
00:21:26	S1	Okay. And do you think that was a good thing or a bad thing?
00:21:29	S7	A good thing because sometimes it makes people in a really bad mood and they take it out on….like teachers when they shout at someone, sometimes they take it out on other people as well.
00:21:42	S1	The pupils or the teacher?
00:21:44	S4	The pupils.
00:21:44	S7	The teachers.
00:21:45	S3	Take it out on like other pupils and stuff.
00:21:48	S1	Okay. So, it was a good thing that they didn't get annoyed with people when they were talking. Okay. (Name).
00:21:53	S5	Well one of the good things about like the teachers in Better Movers and Thinkers they encourage you. Like if you got fed up of doing it and said, "Oh, I can't do it." They say, "No. Just try again, try again." And you would end up getting it.
00:22:06	S1	Okay. So, is that different to other?
00:22:10	S5	It's different to some teachers and some other people that come and they just like give you a task. And then, when they come in to see, they say, "Oh, no. You're doing it all wrong," and stuff. Instead of saying...like maybe saying, "That's really good. Just try and improve on it," or something.

00:22:27	S1	Okay.
00:22:28	S7	Or they don't really help you some of the other teachers. But they like gave you a tip and then said, like will leave you and come back in a few minutes and like some people have worked it out. And then, by that time, you probably have worked it out because the thing they gave you was really good even though it doesn't seem.
00:22:45	S1	Okay. So, sometimes they gave you like a wee tip, and that helped you, helped you improve. That was all you kind of needed to get it. (Name)?
00:22:52	S5	It's like kind of like a sandwich thing. They'll tell you something good and then, they'll tell you something bad and something good. There's more good things than there was the bad.
00:23:03	S1	Okay. And that was a nice...a nice thing. Okay. Was there any other ways in which you learned any activities? We kind of had demonstrations and we had tips and we had practice and anything else?
00:23:17	S2	We did this like jump sequence.
00:23:19	S5	Two, to two to left, to two to right, to right, to left.
00:23:21	S2	Two, to two to left, to two to right, to right, to left, to two.
00:23:26	S1	Okay. And how did you learn that?
00:23:29	S2	We just kept doing it over and over again. Then, if you didn't manage to, then, the teacher would come and show. Because (Name) he kept on saying do it over and over again till you get it correct, for me and (Name).
00:23:44	S6	We don't really have to do that with repetitive. It was more fun because we got to have, like adding our own hand sequence. And we got to go partners and see who could like make up sequences doing it. And then, whatever ideas was best you'd show it to the class.
00:24:00	S1	Okay. And how did you feel when you were learning these different activities?
00:24:04	S5	Sometimes it's fun, sometimes it wasn't really that fun.
00:24:08	S1	Okay. (Name), you want to say something.
00:24:11	S2	Happy.
00:24:11	S1	You're happy. Okay. How did everybody else feel? So, you talked about the way that the teacher was, kind of how did that make you feel? Good?
00:24:23	S3	Good about yourself.
00:24:24	S1	Good about yourself. Okay.
00:24:26	S2	A bit more confident.
00:24:27	S1	A bit more confident. Anything else?
00:24:33	S5	Pleased.
00:24:33	S1	Pleased. Okay. Pleased that you kind of managed to do it.
00:24:37	S6	It was good when you achieved it.
00:24:39	S1	Okay. You felt good when you achieved it. Anything else? What about when it was...you mentioned that some of the things were a bit repetitive. How did you feel then?
00:24:48	S2	Quite bored….a bit bored…..a bit boring.
00:24:49	S4	Then you just get annoyed.
00:24:51	S2	I was really excited to go to it at first say like three weeks everyone was like, yeah, Better Movers and Thinkers then people started to go, "Oh, it's just going to be running around like week one.

00:25:03	S4	Some people started to say when we were just about to walk into the hall, they said, “Running.” Then...
00:25:11	S2	Like they could have added in new things like not just the same things.
00:25:14	S7	They’d whisper to their friends saying “now its blah-blah- blah” whatever task it was next because you knew what it was.
00:25:22	S1	Because you knew what was coming next.
00:25:23	S7	And then people were like going, “Oh, no.” Before they walked in but like in the first weeks they weren’t. It was more exciting.
00:25:33	S6	Because it was a new thing we were doing.
00:25:39	S1	Okay. So, (Name), you said it would have been good if they could have introduced some different things.
00:25:43	S3	Yeah.
00:25:45	S1	Okay. What kind of things?
00:25:47	S2	Going outside more and doing it because he said he'd take us outside.
00:25:53	S3	We went outside twice.
00:25:56	S2	Was it twice or three times?
00:25:57	S1	Okay.
00:25:57	S2	But it was raining some of the times.
00:26:00	S3	No, not that time that it drizzled then it would come off.
00:26:03	S2	Yeah, then it would come off.
00:26:03	S3	I felt cold.
00:26:05	S2	And it would have been fine to play outside.
00:26:08	S1	Okay. Is there any...is there anything that is similar about learning in Better Movers and Thinkers to learning in other lessons? So in language or math or art or...? (Name).
00:26:31	S5	We done like a language or……but I can’t remember what language it was, like a useful kind.
00:26:35	S3	German.
00:26:35	S4	German, Spanish, French.
00:26:37	S5	German, Spanish and French. But that was like because we do French and understood a tiny little bit of it.
00:26:45	S6	That was only as a joke though. That wasn't like him teaching it.
00:26:49	S3	That was just like him saying it….like thank you and stuff.
00:26:51	S6	We've also done this game, it’s hard to explain you like, you done like this; one, two, three, four, five, six, seven, eight, nine, ten. So somebody would like number you and then, I'll close my eyes, and I've got to guess what one it was.
00:27:10	S7	Like memory.
00:27:11	S1	Okay.
00:27:11	S6	Then, after that, once you'd done that, someone would go like this; you cross over and go, one, two, three, four, five, six, seven...wait. No. Six, seven, eight, nine, ten. Then, you choose one with your hands crossed over. Then, you like number it like one, two, three, four, five, six, seven, eight, nine, 10. Then you cross that. And you've got to remember your number.
00:27:37	S1	What did you think of that activity?
00:27:38	S6	That was quite fun.

00:27:40	S3	Then, there's this game where you lie down, and then, and the teacher said to put your left hand up.
00:27:48	S6	So, you'd (Overlapping Conversation).
00:27:49	S1	Let (Name) finish a minute.
00:27:50	S3	Then, you'd do that. And then, you'd put your leg up and then, you go backwards and do it all again.
00:27:57	S1	Okay.
00:27:57	S2	And you had to link up with a partner.
00:28:00	S6	We did like sequences that went like that and then like that.
00:28:02	S1	Okay. (Name).
00:28:02	S5	Or you could like do it with a partner and your partner would like give you a sequence [inaudible 00:28:06].
00:28:09	S1	Kind of touch you and you had to repeat it.
00:28:12	S5	[inaudible 00:28:15] them up and move over. (Overlapping Conversation).
00:28:17	S2	You get harder and harder. And then, you will just walk.
00:28:19	S1	Okay. So, what did you think about that activity?
00:28:23	S2	A lot of fun.
00:28:24	S4	It was fun. Challenging
00:28:25	S1	Why was that one fun?
00:28:27	S4	Because you didn't know what they were going to do.
00:28:31	S1	Okay. So, it was new.
00:28:32	S3	You had to, like if your partner made it really, really long, you'd have to remember it and think. And make sure not to mess up.
00:28:43	S2	And it could be confusing if you didn't...
00:28:45	S6	Then you'd have to keep on doing it until you got it right. That was quite fun.
00:28:51	S1	Okay. (Name), did you say it could be confusing?
00:28:55	S3	Because they could tap you twice on the leg and then, do another. I got it once wrong and it was...I got a bit embarrassed because it was a double head but I did double leg.
00:29:08	S1	Okay. So, you got a bit embarrassed because you got it wrong. Does anybody else get embarrassed at all in PE sometimes?
00:29:19	S3	Yeah.
00:29:19	S1	Yeah. Okay.
00:29:19	S7	Well, once me and some of my friends were taking the mickey out of each other…not like doing it in a bad way, but we were making each other do funny things in the class because we had to demonstrate. I told them to do funny routine. I showed them it and then they had to do it because it was a copy routine. So we were all doing a funny routine and it was dead funny.
00:29:41	S1	Okay.
00:29:42	S7	Then, I collapsed in the middle and falling.
00:29:45	S1	(Name).
00:29:47	S4	There was one thing, it was called copy four. Somebody done four movements, any four movements. And then, your partner had to copy it.
00:29:56	S7	That was what we were talking about. Yeah.

00:29:57	S6	Because remember I was making up that sequence. We made up a funny one and collapsed.
00:30:04	S1	So, that's funny. But maybe embarrassing sometimes. Did you do it in front of the class?
00:30:09	S6	Yeah.
00:30:09	S1	Okay.
00:30:09	S7	That's what I'm good with.
00:30:11	S1	(Name), were you going to say something before Claire?
00:30:17	S5	No.
00:30:17	S1	No. Okay. (Name)
00:30:19	S7	I like showing.
00:30:20	S1	You like showing? You like showing people in front of the class.
00:30:23	S7	Doing sequence with my friends, only sometimes though.
00:30:26	S1	(Name).
00:30:30	S2	I like the one where you did four movements and your partner would need to copy it or something.
00:30:36	S1	Okay. There were some things that you liked about Better Movers and Thinkers and some things that were fun. But some of the things got repetitive. Okay. So, how is it similar at all to other classes? You mentioned that you spoke different languages. Is there anything else that's similar about it to other classes?
00:30:57	S4	No, not really.
00:30:57	S1	No, you think it's very different to all your other lessons?
00:31:01	S4	Not really to some of the PE lessons that we've done. But apart from that…
00:31:07	S6	Well it was quite….it was...the mats, it was quite similar. And the juggling, but I wouldn't say anything else was. Because you don't normally do accents but you do running and side stepping and hopping and stuff like that.
00:31:19	S1	Okay. Can I get you just to move your feet, just around the other way, because the mic will pick that up. So, how is it different then to the other lessons?
00:31:32	S3	Because like you don't normally do the accents and things like that.
00:31:38	S1	Okay. So, it had some new things in it. How is it different to things like that you learn in class, like language or maths or art or music or things like that?
00:31:48	S6	Because you need to do like the hand clap at the same time. But in class, we only like…we don't do that.
00:31:55	S2	We only sit down to do it.
00:31:57	S1	Okay. So, you're sitting down in class. And you're doing work. Whereas in PE...
00:32:02	S6	You're moving about and being active.
00:32:04	S1	Okay. You're being active. Okay. Is there anything else that's different? What about the way in which you get taught, is there any similarities or differences the way the teachers are?
00:32:20	S6	Well, they don't normally demonstrate it.
00:32:22	S1	Okay. So, you don't get demonstrations in regular class. (Name).
00:32:27	S5	Well, like sometimes, like if someone can do it, they would ask that person to demonstrate. Yeah.

00:32:36	S1	Is that different to other lessons?
00:32:39	S5	Yeah.
00:32:39	S1	Okay. So, is it normally a teacher or somebody else that shows you in other lessons? Or nobody...Do you get demonstrations in other lessons?
00:32:50	S4	Not really in class.
00:32:51	S1	Not in class.
00:32:53	S6	Well you do sort of in art and stuff.
00:32:54	S1	In art. Okay.
00:32:55	S3	And math.
00:32:56	S1	And math.
00:32:56	S3	The teacher writes...the strategy or something.
00:32:59	S1	Okay. So, the teacher might show you how to do things. Whereas in PE or Better Movers and Thinkers, sometimes they asked somebody who could already do it to show you. What do you think about that?
00:33:10	S6	It was quite frustrating. Because sometimes it was the same people that were always demonstrating.
00:33:19	S1	Okay.
00:33:20	S6	When other people could do it but they just didn't get chosen.
00:33:24	S7	Because they don't really ask.
00:33:26	S6	Sometimes they chose people that like couldn't do it as good as other people. I think sometimes when I got chosen somebody else should do, because they were better at it.
00:33:39	S1	Okay. What else? (Name), were you going to say something? No? I thought you were about to speak before (Name). So, what else did you think about the kind of people, your classmates getting up and demonstrating? (Name).
00:33:59	S5	Kind of maybe build up your confidence to show things to other people.
00:34:05	S1	Okay. Can you do that, (Name)? Yeah. Okay. So, is there anything else that you'd like to say at all about PE or Better Movers and Thinkers?
00:34:17	S2	The juggling there was one stage where there were different parts. So, some people did it with one hand with...
00:34:24	S4	Two balls and one hand. You threw it up, rolled the other ball forward and caught it in the palm of your hand.
00:34:30	S2	And then, you'd have to do one like that, and then, so you'd put that. And then, the other one you'd have to throw up just to show they're both in the air. And then, you catch them.
00:34:41	S1	Okay. And did you enjoy that or did you not like it?
00:34:44	S2	It was difficult but I enjoyed it.
00:34:48	S1	Okay. What did you like about it?
00:34:52	S3	It was different because you didn't always do the same thing. So, if you were able to do the easy one, there was a harder one. If you could do that, there was an even harder one. So, there was always something else that you could do, if you could do something.
00:35:07	S1	Okay.
00:35:07	S7	It was good ‘cause you hadn’t had it before.

00:35:12	S1	Okay. So, you liked it because it was new. Is there anything else that you would like to say about Better Movers and Thinkers at all? No? Okiedoc. Well, I'll just finish it there. Thank you very much.

APPENDIX C –
Intervention school 3 focus group transcription

Intervention School 3 Focus Group Interview

Duration 39 minutes and 30 seconds

Speaker key

S1 Speaker One (facilitator)
S2 Speaker Two
S3 Speaker Three
S4 Speaker Four
S5 Speaker Five
S6 Speaker Six
S7 Speaker Seven
S8 Speaker Eight

Timecode	Speaker	Transcript
00:00:12	S1	Okay so that's the tape recorder on. We're going to use a second one to make sure in case one fails. Okay, so just before we start so that I can get to know all your names so that I'd be able to identify your voices, can we just go round everybody and can we say our name and can we say what our favourite flavour of ice cream is? My name is (Name) and my favourite ice cream is cherry.
00:00:45	S2	My name is (Name) and my favourite ice cream is mint.
00:00:49	S3	My name is (Name). My favourite ice cream flavour is vanilla.
00:00:54	S4	My name is (Name) and my favourite ice cream is chocolate.
00:00:58	S5	My name is (Name). My favourite flavour of ice cream is mint.
00:01:05	S6	My name is (Name) and my favourite ice cream flavour is chocolate.
00:01:10	S7	My name is (Name) and my favourite flavour of ice cream is chocolate chip.
00:01:16	S8	My name is (Name) and my favourite flavour of ice cream is strawberry.
00:01:20	S1	Okay, thank you very much. So just to kick off, can you tell me what you've been doing in PE since the beginning of the year?
00:01:30	S3	Well, we've had like this...some specialists coming in every PE session. He finished I think it was two weeks ago or a week ago, and he taught us like tennis and rhythm and control. How to control our running. We were like had to do this...I think it's called a relay. We had a baton, we had to run around the hall and we had to pass it on to each other.
00:02:02	S1	What other things have you been learning? (Name)?
00:02:05	S5	How to control the ball when you get a racket. You don't just hit it anywhere. You've got to control the way you're hitting so that you know where the ball is going and your partner knows where it is going.
00:02:16	S1	Okay, (Name).
00:02:18	S6	Juggling. He taught us like how to juggle properly. We could do it with like three or two balls, and what it was... We just do it like that with your left hand and then do it to your right hand, and it was just like to get control with your hands.
00:02:37	S1	Okay, (Name)?
00:02:38	S8	What we've done like head stands and stuff on the mats.
00:02:44	S1	Okay, anything else, (Name).

00:02:46	S4	We've done sequences on the mats...not every week but most weeks for the start of the...the stuff that we do, we've done it all week but it continued to the end but we'd only do it…like only some weeks.
00:02:59	S1	What were the sequences about?
00:03:02	S4	That was...flights, movement... I can't remember the rest.
00:03:09	S1	What kinds of things do you do? Who wants to...? (Name)? No? (Name)? Sorry!
00:03:13	S7	Well, we have a...this soft gymnast mats and we have to pick a partner and we have to make up these sequences but Mr. (Name), that's the PE specialist, gave us specific rules like you have to include in your sequence control, rhythm, timing, cooperation with your partner, flight and travelling in your mats. You have to make up a sequence. We would do...it's like a gymnast, you were allowed to, like jump over each other, do a headstand, do cartwheels, handstand, and we had to all fit it in so it all flow into a sequence.
00:03:58	S1	Okay. Is there anything else that you've been doing since the beginning of the year? What other things have you been doing? Eh, (Name)?
00:04:07	S6	We've done a little bit like volleyball. What we've done is we got like a volleyball. We had two volleyballs...with two people and what we've done was we threw it up and they would throw it down, like bounce it off the ground. We'd throw it, they'd throw it up and we'd bounce it on the ground and then we just like throw it around, the ball would come at different directions and we'd have to catch the ball in that we're like...we completed that little sequence that we done.
00:04:38	S1	Okay, (Name).
00:04:41	S4	We were doing hand claps. 1-2-1-2...[clapping sound]
00:04:48	S1	Okay. (Name) were you going to say something there?
00:04:50	S2	I can't remember now.
00:04:53	S1	Okay, that's fine. You might remember it in a minute. (Name)?
00:04:57	S8	We were doing like claps but you had to cooperate with your partner so they would do like...if you clapped once, then that would be 10 with your hands and then if you clapped...and then if you stomped once with your foot, then that would be 1. So if you've done like two claps, that would be 20 and then another, that would be 21 and then your partner would do it. Then you would add the two numbers together and you would stomp it and then you'd run around again.
00:05:24	S1	Okay, (Name).
00:05:26	S7	We had to get with a partner and we've done accents and we would like run for three like 1-2-3 and then we would like do a knee lift and we would have to try and do that in time with a partner.
00:05:45	S1	Okay, (Name)?
00:05:45	S2	We would skip for three and then we would go backwards and then sideward and front was running that so we would and like that with your partner.
00:05:56	S1	Okay, so lots of different kind of movements and patterns.
00:06:00	S6	That you could control what you're doing, so like if you were playing like a sport. If you play rugby or football or just running in general, you need to pace yourself instead of just sprinting everywhere so as to keep a good like...it's trying to like get our stamina better instead of just running all the time like sprinting then after like five seconds, you're out of breath.

00:06:26	S1	Okay, so is there anything else before we move on to the next bit. What you've been doing this year on PE? Okay, (Name).
00:06:35	S4	We've been doing like feet patterns so it's say right, left, two, two, right, left, two, two. And we did the hand claps at the end.
00:06:49	S1	Okay, so combining all that together. (Name)?
00:06:52	S7	And we were doing tennis and we were like...we would have to like... Once we've got like, I think it was a 109 times... (coughs), excuse me. Just come back and forward, like just hitting the ball without it dropping, we had to do that but sometimes you had to like put it backhand, sometimes you had do it forehand. And we'd run around and like do it...we had to like run for three and then put the ball up in the air, hit it with a forehand and when it comes back down, hit it with backhand, and then start run again and do like three steps and then do that again.
00:07:37	S1	Okay, eh (Name) were you going to say something? Add on?
00:07:42	S6	We were doing like this clap thing and it was supposed to be a fun task. In other school this girl had a partner and her partner had her eyes open and then the girl started doing it with their eyes closed. What we've done is like a group with like a partner. I did it with (Name) and we'd done it...we had our eyes closed and we've done like a clap pattern with their eyes closed. So we had to like.....it was funny.
00:08:16	S1	Together?
00:08:17	S6	Funny.
00:08:18	S1	Oh okay. (Name) were you going to say something then?
00:08:20	S5	Well we did something and you had to lay down and your partner touched your finger and told you 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and then you shut your eyes. Then they touched a finger and you had to tell what number it was, and then to get it harder you had to cross your hands but it was still 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and it made it even harder to do.
00:08:48	S1	Okay. (Name) were you going to say something? No? Okay. So what...how have you found these things that you've learned? Who's first? Eh, (Name).
00:08:59	S4	Some of them are quite hard but some of them are quite easy.
00:09:02	S1	Okay, (Name)?
00:09:04	S6	They were fun, easy, hard and enjoyable tasks that we done...
00:09:11	S1	Okay, so all different depending on what it was. Eh, (Name)?
00:09:16	S7	They were fun but at the same time, we were getting like... a really good PE session. He would sit down and he'd ask…. We had to sit down in a semi-circle and he'd sit at the very end of it and he'd say like, 'What do you need to be a good sports...a good sports runner?' And we had to say you have to have like good timing, good rhythm, good control of your running and like when you're doing tennis, we had... at least once a week, there's this boy called (Name). He used to always say 'Multi-processing.' Because we kept on getting it at the start so we'd never forget that one.
00:10:02	S1	Okay. Is there anything else? (Name)?
00:10:05	S5	I think it's really fun because we learned. We think we're not learning but when we're doing stuff, we're learning stuff but we don't actually know it so like when we come back and...like if we went back just after break time and we're all not switched on, we come back to class and we're fooling around and we just not focused really. And focus because if we're doing like tasks and it was like a fun task and everybody was all excited, and then he was

		like, come in everybody and he used to clap his hands and we all used to come in and what he said was, stop and we had to stop. And a lot of people then stop sometimes so he kept saying it, he kept saying it and I think it got through to people's heads that when you say stop, you stop. That also helped in the class because when our teacher says stop, everybody drops their pencils and just focuses on what the teacher is saying.
00:11:07	S1	Okay. Is there anything else that you've found...do you enjoy stuff that you do?
00:11:13	All	Yes.
00:11:14	S1	So do you think anything different? There's...um, (Name)? Are there something's that you don't like about it? Okay, you don't know. Okay. What kind of things would you like to see in future in PE? (Name).
00:11:36	S7	Like try and do it. We done loads of running and tennis and some volleyball, and juggling. I'd like to try different sports that I haven't really tried before like I've not really tried basketball. But the specialist might come in to P7 and he would say what would you like to learn? I might say basketball because I don't know a lot about it.
00:12:01	S1	Okay, did you get the opportunity to say that?
00:12:03	S7	Yeah.
00:12:03	S1	To choose what you do? Okay. What else? Would you like to say, (Name)?
00:12:09	S6	I'd also like to say basketball. I like watching it on the internet, watching it on the TV but I'd really like to play it and get a chance to see what it feels like to be like doing basketball.
00:12:27	S1	Okay, (Name).
00:12:29	S5	I'd like to like maybe have a chance in primary seven because in primary seven you get the big net out and I'd like to just play with something where the winner stays on and then somebody else comes on and you keep playing it and then the winner at the end is the overall winner. Just so that we have a little bit more competition going on so that we just have more of a competitive side in us.
00:12:52	S1	Okay. So do you not have competitive things just now?
00:12:56	S6	No. Because I play football and at my age group. We don't get like a trophy. We just get like a medal. Everybody gets a medal for participating and what I would like to see in the future when I get older, it will be like competition and it will be competitive. And that's...I just can't wait until I get older and I can start being more competitive.
00:13:19	S1	Okay, (Name).
00:13:21	S4	I'd like to see...I'd like to play...street hockey just on the AstroTurf just have a feel of what it's like because I've never played hockey ever.
00:13:33	S1	Okay, (Name).
00:13:34	S8	I always like...really like gymnastics and everyone would get excited like when they pulled the mats out so that we could do our sequences. So maybe like in primary seven we could have like maybe one day we could do like focus on basketball and then the next day we could have a full day of gymnastics.
00:13:54	S1	Anything else that you would like to see in PE? Eh, (Name)?
00:13:59	S5	Well in our PE cupboard, we've got a lot of like stools and you can like a…like years ago we used to jump off them, and then we get horses. It's

		like it always sits in there and we don't... I always like to bring it out and have a chance to play with it just so that we can try something new.
00:14:21	S1	Okay, so we like to try new things. (Name)?
00:14:23	S7	In our PE cupboard we have, like it's like these beanbag things. We used to use tennis balls for the juggling but I'd really like to...with the beanbags, you just like throw up and see how many times you can clap before it came down. And then, you could like see...like have a competition of who can clap as many times but you're only allowed to throw it at head height or something like that so it is kind of competitive at the same time.
00:15:00	S1	Okay. So is there anything else you would like to see in PE? Okay. What did you...you've talked a lot about some of the things that you did and some of you started talking about the things that you've learned. What kind of things have you learned in PE? (Name)?
00:15:18	S7	We've learned like how to control our running. He was trying to learn us that but sometimes...we like...don't like...we can...we tried to control our running but we get over excited and some people speed ahead and like don't focus on what they're meant to be doing. We learned that by the end of...like by the end of a session we've learned how to control our running, how to control our behaviour while we're running.
00:15:51	S1	Okay. Any other things you've learned? (Name)?
00:15:56	S6	For some people, in the class it was kind of like...when they weren't doing what they were told, or they were just running about and not caring about what the task was. Usually, the PE specialist would say...like say come here and have a word with them to get them back on task and it was like a little bit of motivation for them.
00:16:25	S1	Okay, so kind of learning how to control your behaviour. Okay, (Name)?
00:16:31	S5	I've learned a lot like because last year we didn't have quite a good year with PE, we weren't doing PE a lot but it's a good thing that everybody brings their PE kit and we're desperate to just get outside, sometimes it's like it's really dry and really cloudy and cold but we still go outside we just don't...we never play tennis outside because we've got tennis rackets and tennis balls.
00:16:57	S1	Okay. Any other thing you've learned? Eh, (Name)?
00:17:00	S6	Maybe it's...
00:17:08	S1	Oh, you remembered.
00:17:10	S6	It's kind of like...a lot of people were enjoying PE but when our PE specialist had to move on to other schools, everybody was upset because everybody was desperate, obviously because last year, we didn't get PE at all and we were just sitting in class, always bored, not getting any exercise.
00:17:41	S1	Okay, so you would like to get PE...a lot. Okay. (Name) you were going to say something about the things that you've learned?
00:17:49	S2	I've learned more about tennis because he was telling us how to be good and that so he was.
00:17:55	S1	Okay, so what were many things?
00:17:57	S2	It was good like I don't hit the ball too hard now. [inaudible 00:18:00] I just hit it nice and easy, not far too hard.
00:18:05	S1	Okay, (Name)? Would you say something?
00:18:07	S7	You… we learned how to like...like (Name) not to hit it dead far… very far but when we used to have completion with your partner and we would hit it back and forth, and then you and your partner were only allowed once

		bounce each. We like tried to keep it off the ground but some people were like...not...doing that. They were just like hitting it far away and Mr. (Name), the PE specialist was saying to us...the way you see your racket going, that's where the ball will obviously go. That was like trying to control the ball and under your control.
00:18:55	S1	Okay. So, can you give me an example of how you learned something in PE? (Name).
00:19:09	S5	We were...I think we learned that I don't just... picked up really easy because it was getting easier and easier. And we knew that kind of sport and if we didn't know the sport then we wouldn't know by this time, we would still be a wee bit confused about it. But I think because we know the sport really well, it really helped us.
00:19:36	S1	Okay, so how... (Name)?
00:19:40	S4	By...because we...we had to keep doing it week by week until we've learned it. Then, we'd stop and move on to another sport that I learned by trying harder and harder and harder.
00:19:53	S1	Okay, (Name)?
00:19:54	S6	When we got the mats out, a boy in our class, he liked to be just on his own and he liked to kind of perfect his handstands and how you control it when he's landing again and now he's really really good at them because he's put the time and effort when like if there's been an odd amount of people. He's just said, here you two can work together and I'll just work by myself, and he has perfected his handstands.
00:20:24	S1	Okay, so by practicing?
00:20:25	S6	Yeah, practicing.
00:20:26	S1	Okay, (Name)?
00:20:27	S7	Well when we...were like doing the knee accents, we had to like get a partner and coordinate and I think I learned that by... I never really understanded it at the start, like how to go...because he said like just walk at the start and then knee lift. Well, me and my partner and my best friend....she used to like...we used to try and do it like together. We tried to like, when we lifted our knee up, it was like when you put it back down, that would count as one and we weren't counting that and we used to get like said all the time that's only four steps you're doing because we never knew that when you put your knee down, that's I think...that counts as one.
00:21:17	S1	Okay, so how did you...?
00:21:17	S7	I think I learned like getting told every week and it just stuck on me. Okay that's...two counts.
00:21:26	S1	So getting kind of help when you weren't getting it quite right? Okay. Try not to kick the table guys because it makes it noisy for the recording. Is there any other ways you've learned? So you learned by practicing and you had a bit of help when you were getting things wrong. (Name)?
00:21:46	S5	Like I went home and told my mum what I've done and then I showed it because it's like...it gets stuck in your head and you remember it for ages because it's so...it's just so...
00:22:07	S1	So it's just stuck in your head so you remember how to do it? And then you can do it even when you're not in class?
00:22:12	S5	Yeah.
00:22:13	S1	Okay. (Name)?

00:22:16	S8	It's like what (Name) said. It gets stuck in your head like when you hear a song on the radio and it's stuck in your head so you have to like sometimes sing it to your mum or something but like I've showed it to my mum and my wee brother and everyone and now, they like know how to do backhand, forehand and everything. Then, they can transfer it onto my cousins and stuff.
00:22:37	S1	Okay, so sometimes showing other people helps you learn it better as well. (Name).
00:22:43	S7	You, well you don't always have a partner. I sometimes learned tennis by doing it independently trying to work independent for some of it. Like at tennis, sometimes I'd like to...do it independently and I'd say to my partner, you can go with that person in the class. I'd like to work independently for this bit. And that's how I'll learned like how to do it independently, how to....you don't need to play tennis. You don't always need to like play with another person. You could like get a wall or something and just keep hitting it off, and practice with forehand and backhand.
00:23:28	S1	Okay, (Name).
00:23:30	S6	You get taught something and then when it's stuck in your head and all you want to do is just keep doing, keep doing, and keep doing it. You pretty much become the teacher and you show like your family. And then like, maybe when your cousin comes over, you can show your cousin...something like that and then maybe they become the teacher and it's like, passing on, passing on and passing on.
00:23:56	S1	Okay, that's nice. Has anyone got anything different? Different ways that they learned things or different... Does anybody disagree with anything? So it's not...it's not a test. It's just I'm just asking you what your views are. So everybody's views are important. So how do you feel when you're learning these things? (Name)?
00:24:19	S4	I feel happy because I'm learning new things and I'll keep it in my head for ages.
00:24:24	S1	Okay, (Name).
00:24:26	S5	You feel more comfortable when you're doing it with somebody at the start but when the person came in and talked to us, some of us weren't quite sure about it but when it was our first PE lesson, we gradually went aha! I'm doing this I'm doing this. But when the camera came in, everybody was focused on the camera.
00:24:46	S6	And wasn't focusing on the teacher.
00:24:48	S5	But I think everybody is more confident now doing PE but it's usually just one person out of 21 of us do...do not sometimes forget the PE kit.
00:25:01	S1	Okay. Eh... (Name)?
00:25:04	S6	I think...when I was doing it, so...when you're doing like...if you're like...if you like tennis and you're doing tennis, when you're doing a sport that you like or you love and you do it, it's like a club. When you're doing it, you feel kind of happy because you're doing something that you like and if you do it all the time, you do it all the time. And it's easier for you and then like if you...when you're working in partners when you're doing the tennis, and you're good at tennis, you can like help them get better at tennis. If they get better at tennis, then they'll like it even more.
00:25:47	S1	Okay. (Name).
00:25:49	S7	Well sometimes...in PE sometimes...some things that Mr (Name) would show us, some people wouldn't like. It's always good to let your opinions

		out but sometimes it isn't. Sometimes, it causes bad behaviour and never really...it feels as if that PE session never really...I never really learned anything because of the bad behaviour but when...like. But when you leave, you're like... Like out in the playground, we used to have it before lunch and then on a Thursday it would be like after lunch. Usually when it's before lunch, we'd go out and say to our friends are in different classes. We had a PE specialist today and then you can show her and that makes me feel happy. Like looking at other people being happy.
00:26:51	S1	Okay. (Name) were you going to say something before (Name) started?
00:26:55	S2	No.
00:26:56	S1	Okay. So what about if you don't enjoy things that are in PE? How do you feel then? Er...(Name).
00:27:07	S4	I'll try it but if I don't really like it, I'll try even more but until it's finished because I know it isn't that bad but it is kind of bad but I don't really like it because...yeah, trying it more and trying to get into it.
00:27:28	S1	Okay. (Name).
00:27:29	S8	Well maybe some days it could be like...some people are misbehaving and we don't get on to our best bits and then you feel a bit sad because maybe one day we miss our tennis lot or one day we miss the mats coming out and then you feel like you've not really done anything in that lesson. Then you feel a bit like you're going to miss out on the next lesson.
00:28:00	S1	Okay. (Name).
00:28:05	S6	If you don't...if you didn't like something during PE, you...the more the PE specialist taught us, the more we started getting into it and then we started liking it. I think that's what made everybody start bringing in their PE kits because when they were sitting out reading a book or just sitting there watching. You start to get bored...like getting bored and then it might be something fun that we're doing and then you're like, oh I wish I had brought my PE kit in. I think when they started seeing that they started like...before, like they went to bed, they started getting like a PE kit in their bag. Then they'll be joining in the fun when you're doing the PE.
00:29:04	S1	Okay. So is there any...are there any other feelings when you're doing PE...that you have? How does your body feel when you're doing PE, (Name)?
00:29:19	S5	Happy and comfortable.
00:29:20	S1	Happy and comfortable, that's nice. (Name)?
00:29:23	S4	My body feels energetic and it just wants to do more stuff but when we get back to class, I'm like...I got to...I got to get all this energy out of me.
00:29:32	S1	Okay, (Name)?
00:29:34	S6	When you walk out of PE hall and he tells you to start running and dodging out of running into people, my body starts getting like a little bit of adrenaline in me and then that just... I'm just like I'm always ready for like what we're doing next. If we're doing like a knee accent like start...jogging and everybody else is walking and I'm just like jogging and running in the hall.
00:30:03	S1	Okay, so it's energetic?
00:30:05	S6	Uh-huh.
00:30:05	S1	Okay, (Name)?
00:30:07	S7	At the start, (coughs) excuse me. At the start of the session, nobody really knew what this was all about. So we were like really hyped up and my body

		felt exhausted because I wasn't controlling my running properly. But the next few weeks, that's when Mr. (Name) brought...for the first few weeks, he was seeing how we control our bodies without him telling us that we had to control it properly. And like when we control it properly, my body feel like really energetic and I could run longer and like more speed.
00:30:58	S1	Okay.
00:30:59	S7	Because then you know that I was controlling my running proper.
00:31:02	S1	(Name).
00:31:03	S8	See when it came to like...when it was the very start and we're running, I'd get like a big...like I got a big adrenaline just rushed over me. Then you have to try and contain how fast you're running because you could bump into people and stuff. But then gradually as the weeks went on, we kind of got better at that because we came in and we knew that we couldn't just do circles around the room. We have to do like...like go different ways so then the PE specialist would clap his hands and then you would have to move. Like if he clapped it once, you would have to move left, and if he clapped it right then you have to move to the left.
00:31:50	S1	Okay. (Name) and then we'll move to the next question.
00:31:56	S6	The PE specialist started bringing in these people called Mr. (Name) and Mr. (Name). I think for most people that gave them like a little bit of confidence or to like impress them. Impress like...the teacher and the PE specialist and then show the PE specialist and Mr. (Name) and Mr. (Name) your potential.
00:32:28	S1	Okay. So talking...you've talked a lot about how you learny-...what different things you've learned and how you learned it and how you felt when you were doing that. How do you think learning in PE? Is it similar or different to learning in other classes? What do you think (Name)?
00:32:47	S6	I'd say it's different because...in another class, I saw this class outside and it was like... I thought it was a little bit boring because all they've done was just ran around, and round, and round, and round outside for about 15 or 20 minutes. It was really boring to watch.
00:33:11	S1	Okay, so you think the way that you have PE is better, it's more interesting.
00:33:15	S6	It's like more interesting and it's more energetic and fun and exciting.
00:33:19	S1	Okay, (Name).
00:33:21	S7	I've saw other classes and when we had that good weather Primary 5s went out...at least we had two Primary 5 classes and one would go outside and another would go inside. And then just keep running and really big circles around the playground. It was...they would do it before lunch and then the boys, we have the big football pitch out there and the boys go out and play football on it. It's really popular because like they're like...they get...they get in really like...
00:34:05	S1	Okay, you have to speak up a little bit over the drill.
00:34:07	S7	They get in really like excited about it but then when we come to PE, I'm like that's quite boring.
00:34:17	S1	Okay, how is it similar or different to... stay seated just now, we'll finish in a couple of seconds. We've only got a couple more minutes to go. How is it similar or different to other lessons? Like similar to maths or language or... (Name)?
00:34:35	S7	Because although lesson in math and language is physical things, it's also variable because you're like writing down verbal things but PE, it's called physical education because you need to have movement in it. PE always has

		movement in it and it's like...it's not similar. I don't think its similar to anything like similar to...like...I don't think it's not that similar to like other subjects like...
00:35:09	S1	Okay.
00:35:10	S7	...art isn't really physical neither is math and language because you're just writing down things.
00:35:16	S1	(Name)?
00:35:20	S6	I really enjoy PE. I really enjoy Maths and I enjoy art. When I was a lot younger, like in P2, we all went outside into the infant playground and there was a big snake out there. What we used to do is we used to count and used to walk on the snake. We used to go at 1, 2, 3, 4 and then we used to go all the way up to about 20 or something. Then, we used to like doing a little bit of timesing as well and then, we used to go back inside and say you just do this, do this, do and writing down like times tables.
00:36:03	S1	Okay, so it's better the outside kind of similar? Or do you think...?
00:36:07	S6	A little bit because we walked, we jogged and we run. We ran on the snake and stuff but that's all that I came to see if it was a bit similar.
00:36:18	S1	Okay. Were there any other ways which is similar or different to other lessons, with the other subjects, (Name)?
00:36:24	S7	It was...well, you go until like... In primary 7, you go to (Name) and that is really physical, you get really good subjects. That's really, really fun. PE is sort of similar but you're indoors. (Name) is like outdoors and indoors and you're not in school. So like we're getting a really good education but at the same time having really good fun and getting like muddy and wet and all that. But PE is like...we get dry and we're focused a lot, lot more because we know we're in school. We're not outdoors.
00:37:07	S1	Okay, so you're there to learn. Okay, (Name).
00:37:12	S6	When we go to (Name) in the 1st of September and I just can't wait because it's going to be an experience because you're parents wouldn't be there to make your bed and the teachers wouldn't help you. So it will pretty much be a life experience because you will be jumping off cliffs, you'd be swimming, and you'd be blindfolded walking through the woods trying to navigate your way. Then you have like a map and navigate how to get out of the woods. And what I've heard is on one of the task you need to fall on the rope and I think there's a teacher next to you that that see down and up, so they can pretty much track you. A couple years ago, there's a teacher called Mr. (Name) and he used to throw buckets of water on the people and they used to be like soaking and did't know where they were.
00:38:02	S1	(Name)?
00:38:04	S3	Well, it's...PE is definitely different than (Name) as they were saying. But PE in my opinion sounds a little bit more safe whereas (Name) sounds like a suicidal mission. (Laughter)
00:38:24	S1	Okay, so you like the idea that PE you've got a safe environment.
00:38:28	S3	And you know what you're doing and you know what to expect.
00:38:31	S1	Okay. Is there anything...other ways...? And is that similar to other classes, other lessons like maths or language or art?
00:38:38	S3	Well, it really depends on how the teacher teaches it. Like they...because they taught us a little bit of math and PE with the clapping and the stomping bit.
00:38:54	S1	Okay. (Name).

00:38:58	S4	(sneezes)
00:38:58	S1	Bless you.
00:38:59	S4	Well, talking about (Name) and like (Name) instead of a mid-life crisis, it's like a young life crisis. (Laughter) It's like...who's poking me with sticks. (Laughter) Go away.
00:39:15	S1	I don't have a tissue. I'm sorry. (Laughter) Okay, so just before we finish off, is there any other way in which it's similar or different? And we'll let these other people into the room. Okay, we'll just finish up there because I think there's another group to come in. But thank you very much for...